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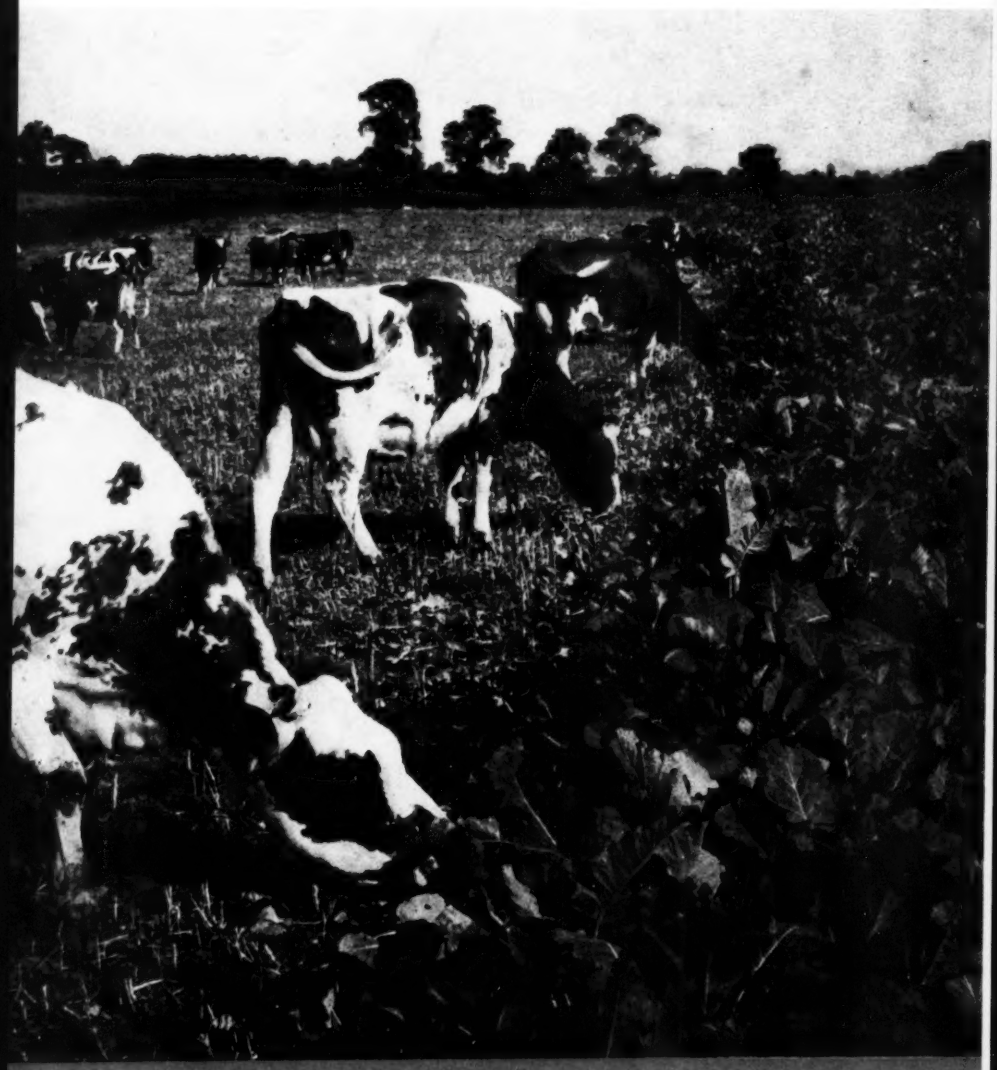

Narcissus Pests

The basic aim of this book is to help the grower to counter the introduction and build-up of pests, and thus to help maximize bulb increase. The present edition has been completely re-written and while the contents and their order have changed considerably from previous editions, the principal objective remains the same: to provide practical advice and background knowledge. The bulletin is illustrated in colour and in black and white.

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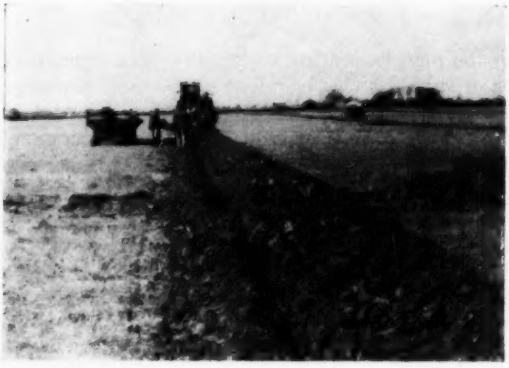


Intensive arable systems need careful planning to enable drainage works to be excavated under dry conditions

Good drainage is essential to a sound farming enterprise. In this article the author discusses how to approach

A Farm Plan for Drainage

H. W. J. Smith

GOOD drainage is without doubt one of the most fundamental requirements of good farming. Few will dissent from this statement, least of all those who have tried to wrest a living from waterlogged land. Yet, surprisingly, few farmers apply themselves to planning a drainage system with the same thoroughness which they will devote to planning other essential parts of their business enterprise, such as cropping and stocking programmes, spraying and fertilizer applications. Most are content, at best, to consider drainage improvements as and when the opportunity arises, generally looking at the needs of one part of the holding in isolation from the rest and trusting to get the work done at a time which will conveniently fit in to the cropping programme.

It is scarcely surprising that in such circumstances it often happens that projected improvements prove to be impossible to achieve without the enlargement, deepening or replacement of carrier drains or ditches installed as part of earlier improvements. Such unnecessary and wasteful expenditure can be avoided by looking at the whole farm and planning a drainage system

that will best meet the needs of the entire area. This can easily be done with an outlay in terms of effort and expense that is small when compared with the benefits to be gained.

Designing the work

The task of drawing up the plan is one for a specialist since it requires not only an understanding of subsoil and crop needs but also a knowledge of field drainage design. The first need is for a field-by-field assessment of drainage requirements, followed up by a survey (including levels if necessary) of those areas where improvement is shown to be needed or likely to become so, in order to determine the layout and depth of the outfall system required to ensure that drains can be laid at adequate depth in every part of the area.

It is in designing the system of outfall ditches that an important 'incidental' benefit can be derived. At the present time, a great deal of effort is spent, particularly in arable areas, in altering boundaries to achieve field shapes and sizes best suited to economic management. If such efforts can be combined with the provision of an efficient system of drainage outfalls, the whole operation is much more beneficial.

Programming the work

Once the planning stage has been completed, the detailed designs of individual field layouts can be happily left until required, in the secure knowledge that they are fully provided for. Now a decision is needed on the programming of the work.

Essentially, of course, this is a matter of budgeting. Expenditure on the necessary drainage improvements may be considered large or small in relation to other items within the business as a whole. Where it is small there may be the opportunity to charge the net cost as an annual trading expense. Where it is large it will need to be treated as a capital investment. The alternatives have different taxation implications on which the advice of an accountant may well be invaluable.

New capital investment has a cost which should be recognized and related to the expected return. The increased yields which may be anticipated as a result of draining may, themselves, require additional investment in terms of increased storage or handling facilities and these also need to be included in the budget. Again, the programme will take into account the different levels of increase to be expected from draining different fields. If those fields giving the best returns can be drained first, they will themselves provide part of the capital to be invested in later stages of the plan.

Timing operations

The work having been planned and budgeted for, the final decision to be taken is one of timing. Many otherwise well planned drainage schemes have failed altogether, or at best been only partially successful, because of being carried out in unfavourable conditions. To give best results, underdrainage needs to be installed by experienced operators in dry conditions and, where laid in an open trench, backfilled with good, dry material. Given this, reasonable after-care and maintenance will ensure best performance for very many years ahead.

There is, however, a conflict of interests involved here. The needs of the

Piped carrier drains must be large enough to deal adequately with the outfall needs of the whole catchment area they are serving

business clearly call for a programme of cropping designed to secure maximum returns year by year; not unnaturally, drainage operations are generally relegated to a place where they can best be fitted in to the needs of the crops when they compete for use of the land. A proper regard for long term priorities will show the need to plan the cropping to fit into the drainage programme rather than the reverse. This will ensure that the land is available for draining at the time when the work can be carried out most effectively, with minimum damage to soil structure.

By planning in this way, it is often possible to drain the land under grass or following early harvested crops such as peas or beans, or before late sowings such as for roots or fodder crops. Where this cannot be done, for instance on land devoted to continuous cereal growing, it is possible to drain through a spring-sown crop in the early stages of growth with minimal damage to the crop. At all costs, it is wisest to avoid relying on having the work done after harvest, when contractors are at their busiest. Inevitably much 'after harvest' work has to be carried out in late autumn or winter, when the land is often too wet to carry contractors' machinery without serious damage to the soil structure.

Planning ahead

The formulation of a drainage plan need not, and should not, await the time when improvements are being put in hand. Whether the whole project is to be carried out as a single operation or phased over a number of years, it is essential that every part of it should fit into the overall strategy for the holding. The drainage system is the essential foundation without which a sound farming enterprise cannot be established. If the enterprise is to be successful it must be soundly based on the most effective system that can be devised without wasteful expenditure. This being so it is surely worthwhile to spend some time and thought on its planning and not to leave it to the changes and chances of piecemeal development. Only when a policy of planned drainage is fully and effectively implemented can the potential of the whole farm be fully realized.

H. W. J. Smith, the author of this article, is an A.D.A.S. Drainage and Water Supplies Officer stationed at Beverley, Yorkshire.

Fertilizer Practice
in
England and Wales

D. Hewgill

INFORMATION regarding the fertilizers applied to individual farm crops is required by the Agricultural Development and Advisory Service to detect differences between farmer practice and advisory recommendations. Initially this knowledge can enable A.D.A.S. to concentrate its attention on aspects of fertilizer usage which offer the greatest scope for profitable improvement. Later it may be used to show how far advisory effort has achieved the desired effect. In other instances the data may point to spheres where further experimental work is necessary.

Information about fertilizer practice is also needed by fertilizer manufacturers to provide estimates of fertilizer consumption in different parts of the country and to assist in forecasting future market trends.

Until recently the data was obtained from a series of surveys undertaken every four to five years in small selected districts. However, whilst this method provided reliable figures for specific areas of the country, the results could not be readily applied at national level and trends could be obtained only by re-surveying the same districts after a period of years. In 1969, therefore, it was decided to adopt a new surveying technique, devised by the Statistics Department of Rothamsted Experimental Station, which aimed at providing estimates of average fertilizer practice for the country as a whole. The work was also planned so that when sufficient data had accumulated it would be possible to provide analyses for various agricultural regions, farming types, soil groups or other distinctive subdivisions.

This article outlines some of the recent trends in fertilizer practice and summarizes the results obtained from the first two years of the new survey.

Trends in use 1962–70

Figure 1 compares the total fertilizer consumption in 1962 with that of 1970. During this period there was a considerable increase in the average use of nitrogen. On both permanent and temporary grass the average use of nitrogen more than doubled, while on arable crops the average rate increased from about 50 units to 70 units of nitrogen per acre. In marked contrast the average dressings of phosphate and potash applied to all crops changed only fractionally.

Practice on arable crops

Table 1 compares the average rates of fertilizer applied to major arable crops in 1969–70 with the recommendations considered by the author to be most appropriate for the conditions in which the crops are most commonly

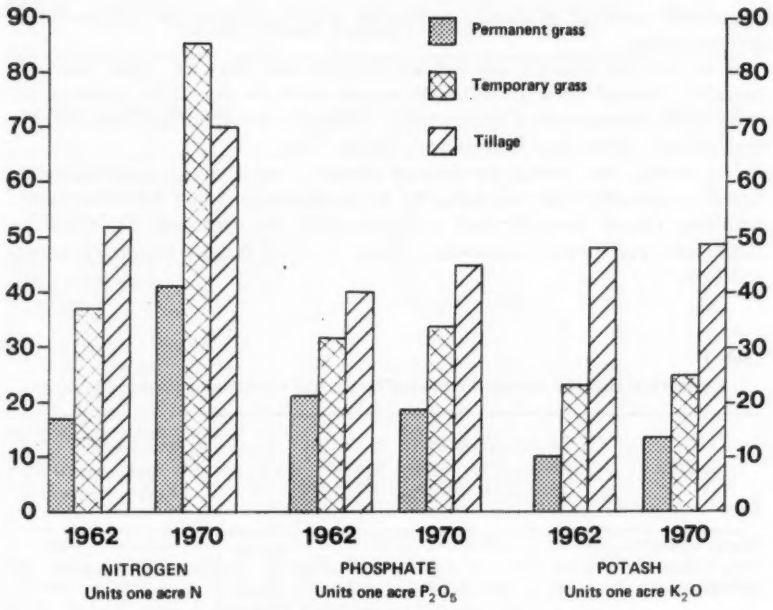


Fig. 1. Trends in Fertilizer Use 1962–70

grown. The recommendations are derived from A.D.A.S. Advisory Paper No. 4* and assume that the crops are grown in an arable system, without farmyard manure, and that the soils have moderate phosphorus and potassium reserves. Only those crops sufficiently well represented in the first two years of the survey are included in the table.

The results show that the average nitrogen dressing for winter wheat is in the middle of the range advised for the drier East and South where most of the crop is grown. For spring barley the average rate of nitrogen used is at the lower end of the scale recommended for drier areas and, since the bulk of this crop followed other cereals, it would appear that more nitrogen could be profitably applied to part of the acreage. With phosphate and potash the average treatment of spring barley and oats is close to the optimum but on winter wheat the average levels of phosphate are higher than generally recommended for all but deficient soils.

On average, maincrop potatoes received less nitrogen and phosphate but rather more potash than is usually advised if the fertilizers are broadcast on the flat. The ratio of plant nutrients suggests that much of the crop still receives the traditional 1:1:1½ compound fertilizer, although recent recommendations are closer to 1:1:1. Early potatoes seem to be treated in much the same way as the maincrop varieties and are apparently subject to an excess of potash above A.D.A.S. recommendations. It should be pointed out, however, that this discrepancy is exaggerated by the inclusion of an

**Fertilizer Recommendations for Agricultural and Horticultural Crops.* A.D.A.S. Advisory Paper No. 4, M.A.F.F. 1971 (in the press).

appreciable acreage of second earlies for which a higher rate of potash is recommended.

Even without making allowances for farmyard manure, sugar beet invariably received more of all three major nutrients than field experiments show to be appropriate. Consequently, it appears that there is a considerable uneconomic investment in fertilizers for this crop.

For swedes and turnips the average practice, including farmyard manure, agrees reasonably well with advisory recommendations. On the other hand, with kale rather more nitrogen could be profitably used, and on beans for stock feed and peas a somewhat higher level of potash manuring seems justified.

Table 1

Comparison Between Average Fertilizer Practice and Recommendations 1969–70

Crop	Units/Acre Used			% with FYM	Units/Acre Advised		
	N	P_2O_5	K_2O		N	P_2O_5	K_2O
Winter wheat*	72	38	32	7	30–100 20–70	30	30
Spring barley*	64	33	34	7	50–120 20–80	30	30
Spring oats*	48	31	28	9	30–80 20–60	30	30
Potatoes: maincrop	129	138	197	36	150–180	175–200	150–200
early	126	133	167	34	120	120–180	90–120
Sugar beet	129	94	152	25	100	50	100–150
Swedes and turnips	46	100	63	35	60–80	75–125	50–100
Kale	84	52	53	41	120	75–125	50–100
Beans (stock)	8	39	28	2	0–20	30	40–60
Peas	4	36	37	2	0–20	20	30–80

(*High range for areas with summer rain below 16 inches)

Practice on grassland

The average dressings of fertilizer applied to various systems of grassland management are given in Table 2.

The table indicates that over half of the grassland acreage is neither mown nor subject to controlled grazing methods. A further 35 per cent, although mown, is again extensively grazed. Not surprisingly the average levels of nitrogen used on these areas are fairly low. The remaining 10 per cent of the acreage is strip or paddock grazed and these are virtually the only areas where substantial dressings of nitrogen are applied.

Average dressings of phosphate and potash appear to be reasonably satisfactory for grazing land. However, even after allowing for the contribution of farmyard manure the average potash applications for mown land are rather less than the 60–80 units per acre K_2O normally advised by A.D.A.S.

Clearly the full potential of much of the grassland acreage is not being realized and there would appear to be enormous scope for future development in this branch of agriculture.

Table 2

Average Fertilizer Practice on Grassland 1969–70

System of Management	% of Grass Area	Average Units Per Acre			% with FYM
		N	P_2O_5	K_2O	
Extensively grazed only					
Permanent grass	42	29	18	11	10
Temporary grass	13	49	29	18	16
Extensively grazed and mown					
Permanent grass	18	45	23	18	36
Temporary grass	17	71	35	26	28
Strip or Paddock Grazed only					
Permanent grass	3	123	29	25	16
Temporary grass	3	164	45	37	15
Strip or Paddock grazed and mown					
Permanent grass	1	80	34	24	55
Temporary grass	3	162	50	40	23

The author of this article, **D. Hewgill, B.Sc.(Hons.),** is a Soil Scientist, stationed with A.D.A.S. at Newcastle. The statistics used in the preparation of the article were provided by Mr. B. M. Church, Rothamsted Experimental Station.

Statistical material derived from the surveys described in the article may be obtained from the Ministry of Agriculture, Fisheries and Food, Regional Administration Branch, Room 214, Great Westminster House, Horseferry Road, London, S.W.1.

PLUM POX

Following isolated outbreaks of Sharka disease (Plum Pox), the Ministry of Agriculture, Fisheries and Food has arranged for sample surveys to be carried out at commercial orchards during the spring and autumn of 1971. An illustrated leaflet has been sent to commercial growers of plums explaining how the disease can be identified.

Sharka disease is widespread in some countries of Europe, where it causes substantial losses. It can affect not only plums but also peaches, damsons and sloes. Apart from an isolated case in 1966, the presence of the disease had not been recorded in England before 1970, when it was identified on a small number of plum trees in Kent.

The major effect of the disease is on the fruit. Affected plums bear conspicuous pale marks and rings which are often sunken, and the fruits may drop prematurely. The leaves also bear chlorotic rings and blotches, but these can be confused with leaf markings of other diseases.

Any grower who sees a number of plum fruits with depressed rings or lines on any of his trees this year should consult the Ministry's Advisory Service without delay. Growers who have not received the Ministry leaflet but who are interested can obtain a copy from the Ministry of Agriculture, Fisheries and Food (Publications), Government Buildings, Tolcarne Drive, Pinner, Middlesex HA5 2DT.

Harvesting citrus fruits

Horticulture in Israel

F. W. Shepherd

THE International Horticultural Congress in Tel Aviv in 1970 gave foreign horticulturists a chance of seeing something of the rapidly developing horticultural industry in that country. This article gives one English visitor's impressions of that industry.

Situated at the eastern end of the Mediterranean, farther south than any European country, Israel has a mainly sub-tropical climate which allows the cultivation of a very wide range of horticultural crops.

Of the total population of nearly three million, about sixty thousand are farmers or growers, including ten thousand part-timers. Another thirty five thousand are employed as seasonal workers for harvesting or other urgent activities. These producers live and work in Kibbutzim, in Moshavim or in villages similar to those in this and many other countries.

Kibbutzim and Moshavim

There are 225 Kibbutzim in which all work is undertaken communally. Much of their production is of extensive cropping or in large scale livestock units, and many of them have also developed secondary industries to occupy the members no longer required in their increasingly mechanized methods of production.

The 370 Moshavim are very similar to the Land Settlement Association estates in this country. The smallholdings are cultivated by the individual producers, who buy their equipment and other requisites and sell their

produce through a central organization. They are growers of high value crops by intensive methods and have the benefits of the cheapest available supplies of fertilizers and other necessities as well as facilities for grading, packing and marketing their produce in conditions most acceptable to their customers, whether in Israel or elsewhere.

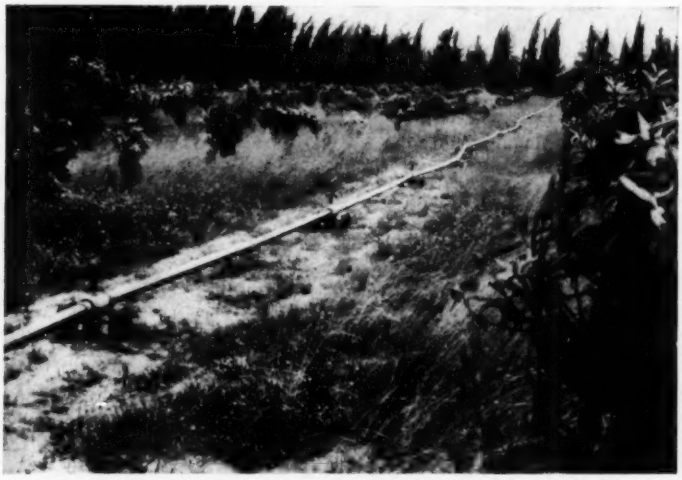
Some growers in the villages, which are more similar to those in this country, specialize in the production of high value crops for local sale or export where large scale marketing is not so important. Such enterprises as chrysanthemum and carnation cuttings and cacti seedlings were among those seen in such situations.

Irrigation

In all there are 420,000 hectares, just over 1 million acres, of cultivated land in Israel and of this 425,000 acres are now irrigated.

In many parts of the country some of the water for irrigation is pumped from wells near to the land to be watered but most is fed through an underground network. The main line of this grid is a pipe some 3 metres in diameter and 220 kilometres in length which starts north of the Sea of Galilee and ends near Gaza in the Negev Desert. As a result of this extensive use of water the flow into the Sea of Galilee and thence south to the Dead Sea has been so reduced as gradually to lower the level of the Dead Sea, which is already 825 feet below sea level.

There is in fact very little water to spare in Israel and it is strictly allocated according to the needs of the various crops. Where tolerant crops will permit some saline water is added to the fresh water, and in other cases sewage water is also used. There is very little furrow irrigation and much of the water is still applied by overhead sprinklers. Various forms of trickle irrigation are, however, being used and more widely tried in order to reduce the water loss which is inevitable with sprinkle irrigation in a very dry climate.



Movable spray line for irrigating mango plantation. Wind breaks are Mediterranean cypress

Crops

Fruit. Of the nearly thirty kinds of fruit which are grown, by far the most important are the various kinds of citrus, which occupy 44,000 hectares of land. Nearly 80 per cent of these are oranges, mostly of the Shamouti variety. About 1 million tons of fruit are produced each year of which 60 per cent is exported, bringing in over £50 million a year. About 30 per cent is processed to produce juices and other products for human consumption. The resulting 100,000 tons of peel are fed to cattle.

Compared with the 44,000 hectares of citrus, the other fruits and nuts occupy relatively small areas of land. The most important are:

	Hectares
Olives	9,000
Wine grapes	5,400
Table grapes	4,000
Apples	3,500
Almonds	3,000
Pears	2,100
Avocados	2,000
Bananas	1,900
Peaches	1,200

There are smaller quantities of apricots, pecans, plums, dates, mangoes and other sub-tropical fruit.

The only temperate fruit which is exported to Britain in any quantity is the strawberry. This crop is produced under plastic tunnels from December to April. American varieties Tioga and Fresno are grown, with a few European varieties, and annual cropping is practised. Some six hundred growers were producing strawberries on just over four hundred hectares in 1970. It was estimated that over four thousand tons would be produced of which about half might be exported. Careful picking and packing and rigid grading ensures attractive looking samples which are sent by air to the main European capitals on most days during the cropping period.

Vegetables. The Israelis are able to have fresh home grown vegetables and salads every day in the year and claim to be among the largest consumers per head of population of fresh vegetables in the world. In the period since 1948 when these crops were in very short supply the area cultivated and the yields have both increased until some 10 per cent of the produce is now exported.

About 24,000 hectares of land are used for vegetable production. This includes strawberries and melons which, being annual crops, are treated as vegetables, and potatoes which are harvested in different parts of the country almost throughout the year.

Half of the area under vegetables is in the Moshavim or co-operative villages and nearly 40 per cent in private villages in Jewish or Arab districts. There, crops such as tomatoes, green peppers, aubergines, artichokes, cucumbers and celery, as well as strawberries already referred to which require more hand labour, are grown on the smaller holdings of these villages. The remaining 12 per cent of land used for vegetables is on the Kibbutzim and is mainly used for producing vegetables such as potatoes, carrots, onions, peas and beans which can be grown without very much hand labour.

More than forty kinds of vegetables are grown in the open and under plastic tunnels. There has, in fact, been a considerable increase in the use of

plastics and in 1970 more than 2,000 hectares of tunnels were in use compared with about 100 hectares of glass or plastic houses.

Among the vegetables which are exported are carrots, onions, lettuce, celery, melons of various kinds, green peppers, aubergines, artichokes and strawberries. Most of these are sent by sea in refrigerated ships taking at least 14 days to travel through the Mediterranean and the eastern Atlantic. A few crops, such as the strawberries, are sent by air so long as prices will pay for the higher freight charges.

Aubergines with nylon shelter screens to protect from drying winds near the Dead Sea

Government services

The horticultural industry is served by free research, education and extension services which are obviously in very close touch with the growers. The free government extension service consists of just over 600 professional staff stationed either at headquarters or in one of the eleven districts. The majority are specialists in crop or animal production, including beekeeping, or in soils, plant protection, mechanization or management. General agricultural or horticultural advisers hardly exist.

In each of the eleven districts the Director of the Extension Service has an Advisory Council of ten farmers and growers, and each of the main groups of crops or livestock such as fruit, flowers, poultry and so on have technical committees consisting of growers or farmers and the extension officers concerned.

The committees submit plans for their future activities in visits, meetings, courses or research which are submitted through their Council to the central office. Visits are planned in advance on the initiative of the extension officer concerned within the overall plan and are not made on request except in exceptional circumstances.

Each specialist extension officer expects to visit each Kibbutz, Moshav or group of private growers in his district five or six times a year and since very few of these groups are specializing in one crop it means that each group

receives one or more visits each month from a specialist adviser. Short conferences or two to three day courses are organized locally but others for periods of up to several months in special cases are organized by a central specialist group who recruit the specialists from the districts as their lecturers. It is estimated that every officer spends some 15 per cent of his time in authorized research work within his district and up to 24 days a year in attending courses or other periods of study.

Marketing

All marketing in the country or for export is controlled by a number of Boards such as The Citrus Marketing Board of Israel, The Production and Marketing Board for Flowers, Bulbs and Decorative Plants and The Fruit Production and Marketing Board.

The Boards consist of representatives of the producers, wholesalers and the Government. The Citrus Board, being concerned with one of the country's major exports, has the Minister of Agriculture as Chairman and representatives of the Ministers of Finance and of Commerce and Industry together with a majority membership of representatives of the citrus growers. The remainder market their produce through Agrexco (the Agricultural Export Marketing Company) which is jointly owned by the Israeli Government and the various Marketing Boards.

The Boards organize production and encourage research on the Government Stations and control quality and quantities being sent abroad. Agrexco organizes the transport and marketing through agents in the main production areas and in the main countries receiving the various products from Israel. All citrus is marketed under the brand name JAFFA and all other produce under the CARMEL brand.

In order to ensure a high standard of produce Agrexco employ specialists in the grading and packing of all the main crops for export who make regular visits to growers during the marketing season.

This very considerable concentration of horticultural advisers and marketing specialists appears to ensure the rapid dissemination of information from research stations in Israel and elsewhere and from growers in countries such as the United States of America where climatic conditions are similar. This leads to high standards of production and rigid grading standards and thus high quality for export.

Impressions

Less than three weeks in any country, much of it spent in a thriving modern town such as Tel Aviv, does not entitle one to evaluate or criticize its horticultural industry. The impression gained, however, is of a people with a great knowledge of the condition of their country and a strong desire to help its economy and themselves. This is partly brought about by the considerable involvement of everyone in the military activities which were so obviously necessary at the time of the visit, but is also a reflection of the determination of the Israelis to bring their country back to the land flowing with milk and honey and to quote the motto for the Congress to 'make the desert bloom'.

Within this environment the horticultural industry is developing with considerable Government aid and very active individual initiative and has become of great importance to the nation. It sets out to provide adequate supplies of all fruit, vegetables and ornamentals required by the home

Harvesting strawberries from under polythene tunnels

population in order to provide a complete diet and to reduce imports to the absolute minimum. At the same time, they are setting out to produce these same horticultural crops at seasons of the year and of the quality and price required for export to other countries in order to obtain the maximum quantity of foreign currency.

F. W. Shepherd, N.D.H.(Hons.), F.I.Biol., is the Ministry's Senior Horticultural Adviser with A.D.A.S., London.

WATER FOR AGRICULTURE

The improvement and expansion of farm water supply systems over the past 30 years is one of the less obvious but basic achievements in the equipment of agricultural and horticultural holdings. Public water supply mains have been considerably extended and many thousands of farm water systems have been installed, replaced or improved. This work is still going on; over 3,200 farm water supply and irrigation schemes with a total value over £1½m were approved for grant in 1970. Apart from irrigation schemes, much of this work has been to improve the quality of water for dairy purposes and to provide piped water supply to fields for stock drinking.

The work continues with changing emphasis according to the needs of the day. In addition to the improvement of poor quality sources, changes in farming policy, amalgamations, boundary changes and the extension of grazing areas in hill land require the development of new sources and systems or modifications and improvements to existing arrangements. Increased attention is also being directed to the quality of water for livestock drinking and the substitution of good quality piped water in place of suspect sources of drinking water, such as ponds and streams, which are liable to pollution and may contain disease organisms from infected animals, toxic chemicals and other substances which are a potential hazard to the health and development of animals.

Although the majority of farms are now connected to the public water supply system, many holdings retain the use of private sources such as wells, boreholes and springs in addition to the public supply. In remote areas where mains water is not available, there is no alternative. To provide guidance in the development and improvement of private sources, with a view to obtaining a good quality supply, the Ministry has published a free leaflet (see page 315) entitled *Protecting your Water Supply*. This leaflet, with the help of sectional drawings, illustrates methods of constructing source works, reservoirs and other items of water supply systems, with particular attention to the protection of the supply from pollution. Another leaflet in the series dealing with water supply for irrigation entitled "Thinking Irrigation" is to be published very soon.

Trends in Food Marketing

John M. Slater

THE continuing interest in food marketing is not surprising when it is realized that, out of a total consumers' expenditure of £31,124m in 1970, expenditure on food and drink accounted for just under £9,500m. Expenditure by households on food alone represented 20 per cent of consumers' expenditure and if purchases outside the home are included the proportion would be over 25 per cent. It has been estimated that the cost of processing and distributing this food is currently just over 50 per cent of the retail value and that the marketing bill has risen by nearly one third since 1963. This growth in the marketing sector has been accompanied by significant changes and the purpose of this note is to identify the more important trends, some of the factors underlying these trends and possible implications. The diagram opposite illustrates some of the forces at work.

The Consumption sector

Even at constant prices total United Kingdom household expenditure on food has risen by about 0·9 per cent per year over the last few years, the greater part of this increase being accounted for by the rise in population. As real income rose on average by 2 per cent per year over the same period this indicates that, despite spending a larger absolute amount, a smaller proportion of consumers' income is being used to buy food.

While the average calorie intake per person has remained remarkably stable, important changes in the pattern of consumption are taking place. This pattern is well documented in the reports of the National Food Survey which show that expenditure is being redistributed towards the high protein, low calorie foods; more meat is being eaten relative to the starchy foods. The more significant changes, however, are taking place within the broad commodity groups. For instance, per capita consumption of poultry and ham has been rising while that on beef and mutton and lamb shows no apparent increase. Consumption of cakes and biscuits has been increasing while per capita consumption of bread has been declining fairly steadily for some years. In terms of expenditure, the relative patterns of consumption are very similar although per capita expenditure on very few foods has actually fallen and even expenditure on bread shows a slight upward trend.

Also consumers are demanding better quality foods more conveniently presented. The past few years have seen an increasing volume of food being sold prepacked and semi-prepared and expenditure on those foods defined by the National Food Survey as convenience foods has been rising at about

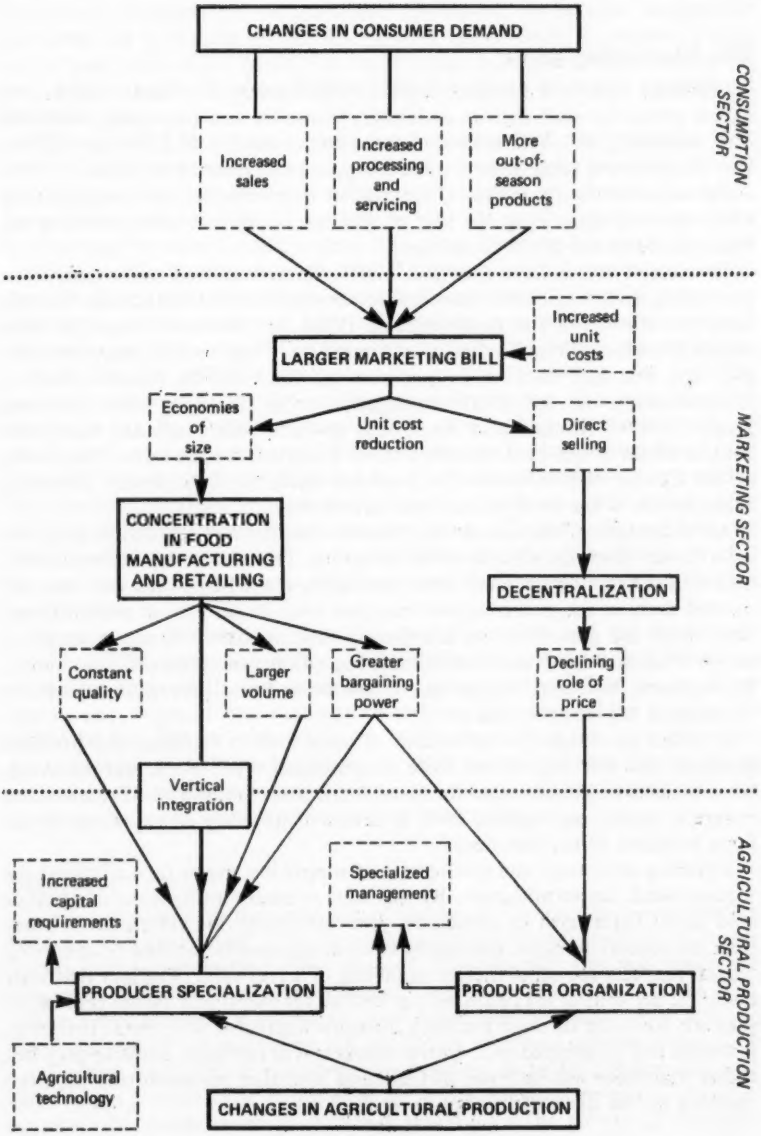


Diagram illustrating major trends in food marketing and some of the forces at work

5 per cent per year. The demand for more out of season and exotic foods, particularly fruit and vegetables, is being met by increased supplies, and the growth in the frozen food market has continued.

The Marketing sector

Increased sales and services, together with increases in unit costs due to higher prices for such factors as labour, transport and packaging, raise the food marketing bill. It is estimated that compared with £2,277m in 1958 the cost of marketing food in the United Kingdom had reached £3,647m by 1969. However, economic pressures in the market have been directed to improving efficiency and containing the size of the marketing bill while meeting the changing demands of the consumer.

Two major trends have emerged. The economies of scale to be realized in processing and distribution have led to considerable rationalization in both food manufacturing and food retailing. It has been estimated that the three largest firms in the bread industry accounted for 17 per cent of output in 1951 and that this had risen to 61 per cent by 1969. In the biscuit industry, rationalization has led to the amalgamation of 8 major firms into two groups, United Biscuits and Associated Biscuits which between them now control about 50 per cent of total United Kingdom biscuit sales. The results of the Census of Production for 1968 are likely to show similar trends in other sectors of the food manufacturing industry.

An indication of the change in concentration in food retailing is given by information from the Census of Distribution. This shows that between 1957 and 1966 the number of retail food establishments fell by 17 per cent and the market share of the mutiples rose from just over 20 per cent to nearly 33 per cent. With the growth in the number of supermarkets offering a complete range of foods a significant reduction in the number of specialist food shops, for instance, butchers, bakers and confectioners and greengrocers, can be expected in the next few years.

In order to obtain the economies of scale and to establish the branded products characteristic of the more concentrated types of market structure, there is an even greater need for firms, both manufacturers and retailers, to ensure a continuous supply, both in terms of quantity and quality, of the farm products which they need.

Ensuring continuity and conformity of supply is a major factor behind the second trend, decentralization. By this term is meant an increase in produce sold direct from farm to processors and distributors or via channels other than the central markets. Increasing costs of transportation and of operating central markets are other factors in favour of direct sales. The fact that only about 52 per cent of fat cattle, 60 per cent of fat sheep and 14 per cent of fat pigs are now sold through livestock auctions highlights this trend. However, it should not be inferred that central markets will not have a role to play but rather that there will be fewer of them and a smaller proportion of the total produce will be directed through these markets.

The Agricultural Production sector

Simultaneously the farming sector has been undergoing change. To meet the demand for large or continuous volumes of a high quality product more specialization in production is required. In some cases there has been vertical

integration but, apart from a few isolated instances, this has taken the form of production under contract rather than complete integration. Certainly increased capital requirements and the need for improved technology and specialized management suggest the likelihood of further integration. However, for a number of reasons, notably the diversity of enterprise even on the more specialized farms, it is unlikely that complete vertical integration will make significant in-roads into the production of many agricultural commodities.

Although the average size of farm has been growing*, the increasing concentration of food manufacturing and food retailing firms has led to greater pressure on the bargaining position of individual producers. Similarly, decentralization may lead to a declining role for market price unless price information on sales outside central markets is more readily available; with smaller volumes passing through central markets, auction prices may reflect the sale of only residual produce. In order to improve the bargaining position and to ensure the necessary price information, a move towards increased producer organization seems likely. Already there has been some movement in this direction with the formation of marketing groups and with the increasing interest in market intelligence and grading. Provided adequate standards can be worked out, extension of a system of classification or grading to a greater number of farm products could play an important role. Not only would producers be able to assess price information more readily but improved product standardization and purchases on grade specification could bring benefits to processors and distributors. Theoretically, grading also provides the consumer with additional information, with the result that changes in final demand are reflected more efficiently through the market mechanism.

The changes in consumer demand discussed earlier, and the consequent growth of the marketing sector, suggest that the producer will receive a decreasing share of the consumer £. This does not imply that the producer will be any worse off but one way to increase his share of the retail value would be for him to perform more of the marketing function. How far developments in producer marketing are likely to proceed may depend on the success of the newly-formed marketing groups and the conflicting need for producers to specialize on the function of production.

Summary

The implications for the consumer of the changes taking place in marketing food are the availability of a generally wider choice of products of better quality and incorporating more services. Undoubtedly this will mean the consumer buying more expensive foods.

The rationalization required to meet consumer demands while holding down the size of the marketing bill has led to increased concentration, with its resultant emphasis on non-price competition in the food processing and distribution sectors. The subsequent need for firms to ensure continuous supplies of a standardized product has accentuated the growth of contracts and the trend towards decentralization.

*The average size of farm in England and Wales, excluding the holdings defined as statistically insignificant, rose from 80 acres in 1960 to 99 acres in 1969. In 1960 holdings of over 300 acres accounted for 28·4 per cent of the acreage of crops and grass while holdings in this size group represented 37·2 per cent of the acreage in 1969.

In the production sector, the necessity for larger farms and greater specialization suggest greater reliance on outside finance as well as more specialized management. Increasing concentration on the buying side seems likely to lead to greater producer organization while concern for the declining share of the consumers' £ passing to producers and the increasing number of contracts has already led to a substantial growth in the importance of marketing groups.

The trends which have been discussed are the outcome of the interaction of market forces. To a greater or lesser degree they have been developing over the years and will continue to do so. However, as food policies are changed and economic circumstances altered so too will the importance and emphasis of individual trends.

This article has been contributed by **J. M. Slater, B.Sc., M.S., Ph.D.**, of the Ministry's Economics and Statistics Division.

Rating Act 1971 — Effect on Farm Buildings

Under Part I of the new Rating Act certain additional categories of buildings used by farmers in England and Wales will be exempted from rates from the beginning of the present rating year, i.e., 1st April, 1971.

The buildings concerned are (*a*) those used solely for the keeping or breeding of livestock, i.e., mammals or birds used for the production of food or wool or for their use in the farming of land; (*b*) ancillary buildings (other than dwellings) used solely in connection with operations in the livestock buildings; (*c*) buildings (other than dwellings) occupied by beekeepers and used solely in connection with beekeeping.

To qualify for exemption the buildings must be surrounded by, or abutting, at least five acres of agricultural land (which need not be in the same occupation). In establishing the contiguity and extent of the agricultural land, any roads, railways, or watercourses are disregarded.

Exemption for buildings occupied by agricultural co-operatives, whether corporate or unincorporated, has been extended so as to bring it into line with that for individual farmers.

Exemption is extended to land occupied and used solely in connection with any of the buildings referred to above. Provision is also made for exemption to apply in cases where buildings are in mixed agricultural use, i.e., used partly in connection with operations on agricultural land and partly for livestock production.

In establishing eligibility for exemption from rates, separate parts of buildings will be considered independently: this means that where a separate part of a building is used for an agricultural purpose and another is not, the former will be exempt and the latter will be rated. And in determining whether a building is used solely for a qualifying purpose, no account will be taken of any time the building is used for other purposes if this does not amount to a substantial part of the total time for which the building is used.

The aim is to amend valuation lists to exclude buildings or land newly entitled to exemption before the end of the present rating period. To assist in this process, farmers and co-operatives who think their buildings or land now qualify for exemption are advised to contact their local Valuation Officer.

Similar provision for Scotland is made by Part II of the Act.

Indoor Storage of Ware Potatoes

O. J. H. Statham

RESEARCH work at a number of Institutions, in particular the Potato Marketing Board Research Station at Sutton Bridge, has resulted in some firm recommendations as to the optimum storage conditions for potatoes, particularly where long-term storage is envisaged, i.e., after the end of March.

The best conditions for ware potatoes may be very simply described as:

1. a storage temperature of 4·4°C;
2. as high a Relative Humidity as possible, the objective being 95 per cent.

Management of potatoes at loading and during curing can be more difficult to quantify as it depends very largely upon the conditions of the potatoes going into store, e.g., how much damaged, if wet, the amount of soil, and level of latent disease. The importance of a curing period, that is of high temperature and humidity (12·8–15·6°C for 10 days at 95 per cent R.H.), has been well demonstrated in this particular year, which has been associated with high levels of mechanical damage.

Whatever management recommendations are adopted the establishment of an environment is called for, the principle constituents of which are

temperature . . . humidity . . . rate of air movement.

The primary agent for influencing these three conditions is ventilation. The secondary agent is the storage building itself.

The storage building is really only a shell designed to minimize the interaction between the environment established inside and the fluctuating ambient conditions outside. Satisfactory indoor storage, therefore, requires a building which performs the essential functions of

weather protection . . . insulation . . . retention.

together with environmental control machinery which is capable of modifying conditions inside the store within the parameters set by extremes of ambient conditions, the respiration and condition of the potatoes and the effectiveness of the storage building in preventing any interaction.

Temperature maintenance

Consider first the maintenance of a temperature regime of 4·4°C. To begin with, the thermal insulating properties of the building will have a changing role, from frost prevention during the early months of storage to one of solar heat gain prevention in the last months of storage. The size and shape of the building significantly affects temperature, for any interaction between internal and external temperature is directly proportional to the surface area of the building. Hence there is an advantage of scale (surface area to volume ratio

in a bigger store is reduced). Also the shape is important; a long narrow building exposes more surface area than a square building.

It is obvious that if a store has little or no insulation, is rather small and of the wrong shape, then more elaborate and proportionately powerful environment control facilities such as fans, heaters and refrigeration equipment are needed to guarantee the maintenance of a temperature regime. Humidity within the store is controlled more by the ability of the construction materials to allow the passage of moisture vapour than by the size and shape of the building itself. A higher level of humidity in the store than outside will result in a vapour pressure gradient across the wall or roof, with the inevitable passage of water vapour across that gradient.

For a given storage environment, the interplay between a building and the control machinery needed must be fully understood. Then the design of a store will result in a more functional building, probably at a lower cost.

Design and materials

Consideration of the storage building in more detail shows the need for compromise features in conflict with the pure, minimum-interaction, shell concept. For example, access must be ensured for inspection and loading and unloading. In practice this means doors at least 12 ft square and these are difficult to seal and insulate and expensive to hang. Access for unloading should, ideally, be provided for 'management parcels' of up to 200–250 tons of potatoes.

Not only is a square building a good shape for maintaining environment but it is also, fortunately, the building with the shortest practical perimeter for any given superficial area. A potato store needs sophisticated walling for retention and insulation and because this is expensive the shortest perimeter is best. Perhaps the greatest saving in cost per ton stored comes from increasing store depth. For example, by increasing depth from 8 ft to 12 ft, a 50 per cent increase in capacity, the likely increase in building costs is only 10–15 per cent. Twelve feet is the commonly accepted maximum bulk storage depth in this country and less should not be contemplated in a new store. There is a very strong argument for deeper storage, certainly to 15 ft, particularly in a box store where there is no thrust load on the walls; indeed, stacking boxes high is the only way in which their very high cost can be offset by a lower building cost when expressed on a per ton basis.

The tremendous development of new building materials and construction techniques offers many new possibilities to the producer erecting a new store. So much so that it is surprising to see so many traditional structures still being erected, particularly as the performance of the materials used has often been outclassed. Traditionally each of the essential functions of weather protection, insulation and retention is performed by a separate material. For example, a portal frame building is clad with asbestos cement sheets, insulated with a glass fibre mat and has an internal thrust resistant wall of preformed steel sheet. Not only are some of these materials unsatisfactory for the purpose intended but, on site, they are difficult to marry together, expensive in labour to erect and their piece-meal erection creates problems.

What is required are composite materials combining all three functions. Figure 1 is an example of such a structure at the P.M.B. Research Station. Made of 4-inch thick polyurethane with aluminium sheet bonded to each face, this ultra lightweight panel, which could be used to infill a portal frame

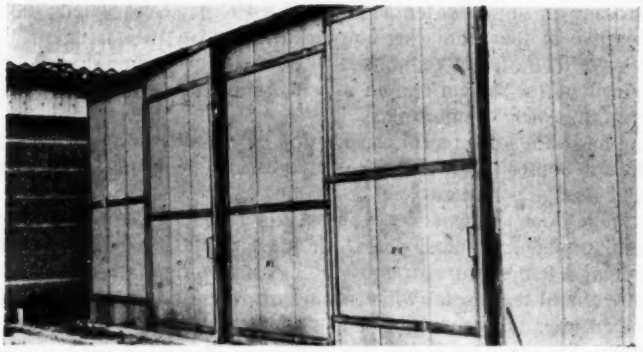


Fig. 1. Composite materials used in a store at the Potato Marketing Board Research Station, Sutton Bridge

structure, is a superb insulator (insulation value = 0·284 W/m² deg C), is fully weather and vapour-transmission proof and can, when properly supported, withstand the thrust from bulk stored potatoes. Another composite example is reinforced lightweight insulating concrete panels.

Thermal insulation

Careful consideration of the thermal insulating properties of the store wall and roof will not be unrewarding for those are the properties most important to the potato environment. Demonstrably an insulation value of 1·136 W/m² deg C is adequate for frost protection; if, however, long-term storage is the aim, the problem of solar heat gain is the more critical and a value of 0·568 W/m² deg C is recommended. Because much of the cost of thermal insulation is in erection, an increase in thickness does not proportionally increase costs.

There can be little said in favour of straw when it is realized that in a typical 500 ton store 18 per cent of storage space is lost with a single bale thickness round the walls. Proper thermal insulation is, in fact, cheap in relation to the benefits it can bring, such as reduced environmental plant capacity and improved ability to maintain a temperature regime in the face of adverse ambient conditions.

It has been pointed out that water vapour can cross a wall; some of this vapour can condense out in and damage an insulant despite protection in the form of a vapour barrier. Such barriers are frequently ineffective because their continuity is not maintained, e.g., perforations of a polythene envelope protecting glass fibre by the fixing bolts for the asbestos cement outer skin. A non absorbent insulator such as extruded expanded polystyrene, the thermal properties of which are virtually unaffected by moisture, is really essential in a potato store with its conditions of high humidity and the pressing need to maintain effective thermal insulation over the life of the building.

Environmental control

Turning to the actual control of environment in the store, it is necessary to consider, in the light of storage developments, what plant is necessary and what the advantages and disadvantages of different systems might be. For

ware storage an optimum temperature of 4·4°C has been stated; therefore, the objective of the ventilating equipment must be the attainment of that temperature in the most economical way. Air movement velocities will be determined by the system chosen as will, to a lesser extent, humidity; but temperature is of first importance.

There has been some recent clarification of views about the best means of temperature control, with a choice of two basic systems depending upon the length of storage period envisaged.

If storage does not extend beyond April, judicious use of cool ambient air ventilation will in most years, for most of the season, be capable of maintaining a temperature around 4·4°C. A simple ventilating fan controlled by a differential thermostat which would operate the fan whenever ambient air temperatures fall below potato stack temperatures are the rudiments of the system. Fan size is related to cubic feet of air per minute per ton and there is a strong argument for an adequate fan capacity—not less than 40 cfm/ton. High airflow rates have the following advantages:

1. Rapid cooling to holding temperature after curing period.
2. Ability to make better use of cool ambient periods if they are of short duration.
3. Evaporative weight losses are not proportional to ventilation rate.
4. Ability to air dry wet loaded potatoes.

Figure 2 is a representation of an ambient air cooling system capable of being fully automated.

Probes are placed within the potato stack at varying levels in order to take account of any temperature gradient existing within the stack. A temperature sensing probe is positioned outside the store to monitor the ambient air temperature and another is introduced within the air stream from the fan to monitor the inlet air temperature into the store. One control knob is set to the desired stack holding temperature and the temperature from all probes in the stack is averaged in the control unit. If the store temperature is above that set by the control knob, fan cooling will be necessary. However, the fan cannot operate unless the ambient temperature, as measured by its probe, is below the stack temperature. The differential is pre-set within the equipment and as soon as cooling air is available at a sufficiently low temperature, i.e., 1 to 2°C below stack temperature, the fan will operate. The ambient air louvres are always closed to avoid the introduction of cold air when the fan is switched on and initially warm air is circulated from the store. However, the probe in the air stream monitors the temperature and the air is delivered at the temperature set by the air supply control (in practice about 1°C below store holding temperature) because the louvres are automatically adjusted by the electronic control unit to give the correct mixing of store and ambient air. If the ambient air is below the desired duct temperature a signal from the control unit operates the louvre motor to open the louvres enough to give the correct air stream temperature. If the ambient temperature rises, the louvres automatically open more to compensate for the increase; they close if the temperature falls. Once the store is back to its correct temperature the fan automatically stops.

When potatoes are to be stored after April the likelihood of ambient air being available at low temperatures is greatly diminished and refrigerated cooling must be used if the stack temperature is to be kept to 4·4°C. It would be possible to introduce a refrigeration unit into the automated ambient

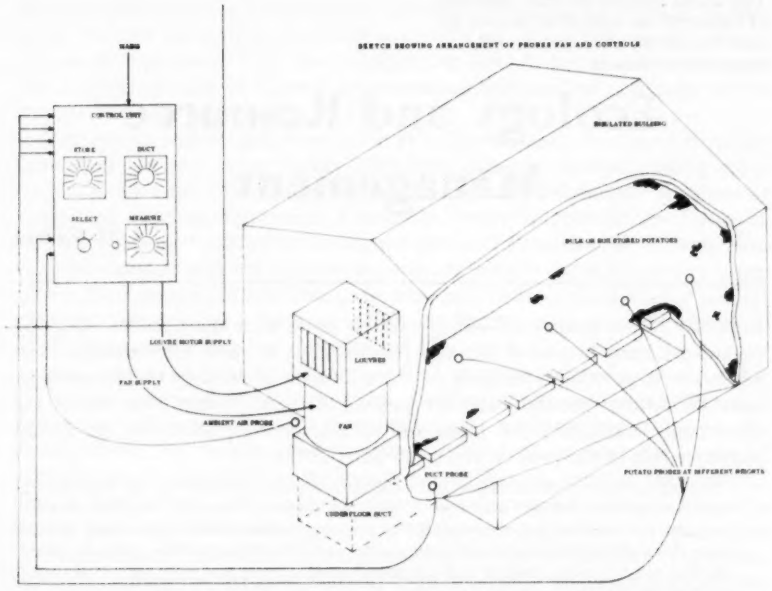


Fig. 2. An ambient air cooling system capable of being fully automated

ventilation system described above to operate when ambient conditions cannot satisfy requirements. Alternatively the refrigeration plant could operate as the sole means of temperature control using continuous recirculated air. Both arrangements have their advantages and disadvantages; in the latter case the equipment would be more expensive to operate but does have the advantage of being able to maintain a constantly high relative humidity in the recirculated air.

Within the two broad approaches of ambient air cooling and refrigeration with recirculation of air there is scope for variation of all things not least the degree of sophistication of the control system. However, as this article has tried to point out, choice and operation of any environmental control equipment must be in relation to the characteristics of the storage building and a more careful choice of all the component parts of a potato store can be very advantageous to the grower concerned.

The author, **O. J. H. Statham, N.D.A., N.D.Agr.E., M.I.Agr.E.,** is the Machinery Officer of the Potato Marketing Board in London.

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This article describes how the University of Edinburgh has tackled the present day need for, and the philosophy behind, specialist education in

Ecology and Resource Management

J. M. Caborn

ECOLOGY is the branch of biology which deals with the habitats of living organisms, their modes of life and relationships to their surroundings. The 1960s saw a growing awareness of the relevance of ecology to the management of natural resources and for guiding attitudes towards our whole environment. Illustrating this trend and its underlying philosophy, Sir Julian Huxley wrote in the *New Scientist* (27 June 1963):

> 'Human ecology involves finding out what resources are available in our environment and how to make the best use of them. We have to think, first of all, of all the material resources—minerals, water power, soil, forest, agricultural production—but we must also think of the non-material or enjoyment resources of the habitat, such as natural beauty or enjoyment, interest and adventure, wild scenery and wild life . . . if man is responsible for the future of this planet, he must pay more attention to ecology—the science of relations between organisms and their environment.'

In the same year, a Committee appointed in 1961 by the Advisory Council on Scientific Policy to advise on the promotion of research into natural resources reported (Cmd. 2163, October 1963). The Committee stated that although there were as yet no university departments of ecology, the study of ecology would become increasingly emphasized 'both because of the deeper intellectual exercise causal analysis brings and because of its importance for the practical problems of developing natural resources'. This Committee concluded that the study of ecology would benefit from a close association with fisheries, forestry, hydrology and land use, a view endorsed by the Committee of Enquiry into the Organisation of Civil Science (Cmd. 2171, October 1963). The latter noted that the problems of preservation, improvement and proper utilization of our natural resources would involve a variety of disciplines, and in many cases the pure and applied aspects would be inextricably mixed. That a range of disciplines and activities should be involved is implicit in the recommendation of both these Committees that a new Natural Resources Research Council be created, with responsibility for research into terrestrial ecology, land use and forestry; for the soil surveys; for research into hydrology, fisheries and related aspects of aquatic biology, together with oceanography. Under the title of the Natural Environment Research Council, this body was inaugurated in 1965.

Ecology and education

Meanwhile, the importance of ecology as a component of biological teaching at various levels was beginning to be appreciated. Schools were developing field studies in the natural and environmental sciences. In the universities major advances in biology had diverted more and more specialist attention towards the cell and the nucleus, and studies of the whole plant or

whole animal were less popular there; the rise of ecology afforded an opportunity to look not only at the whole organism but at associations and populations of organisms in all their challenging complexity. In addition, there was a growing body of interest in the renewable biological resources and in the environment in general.

During this period, questions arose as to the necessity for four University schools of Forestry in the United Kingdom, training graduates along more or less similar lines for a diminishing number of professional openings at home and overseas. Edinburgh University, forced to consider the future of its own Chair of Forestry following the death of Professor M. L. Anderson in 1961, decided that the existing department should expand to cover other renewable resources in addition to forestry and to be responsible for general ecological teaching and research within the Faculty of Science. Professor J. N. Black was appointed to the re-styled Chair in 1963.

New courses at Edinburgh were planned to provide an education for potential managers of natural resources, rural planners, conservationists and ecologists, leading to careers in management, teaching, research and administration. The original forestry courses, evolved to meet the needs of recruits initially destined for the Indian Forest Service, later for the Colonial Forest Service and, later still, for the U.K. Forestry Commission, had a strong professional orientation, equipping the young graduate for immediate professional and technological responsibility in one of the forestry services. Specialist courses in the new teaching areas of wildlife management and land use could have been provided parallel to the forestry specialization. On the other hand, it was recognized that there was much in forest management, with its long tradition of yield control, regulation of the standing capital and regeneration measures, which could usefully be extended to other resource management fields where management had not yet acquired such a degree of sophistication. Furthermore, changing attitudes already evident clearly indicated a need for graduates who were no less competent for professional employment than previously but were, in addition, acquainted with natural resources over a broader field. The new courses had, therefore, to provide graduates capable of critical assessment of management problems in any field and not restricted to a narrowly specialized area. Inevitably, this resulted in the reduction of the technical content of courses in order to make room for greater concentration on principles.

Ecology and management

Balancing the demands of general ecology, as a discipline in its own right, and management subjects presents certain difficulties. Management teaching in all fields dealing with the land in its widest sense must, however, be based on an adequate ecological foundation. It may be argued that an adequate education in ecology, to include the basic sciences on which ecology depends, must seriously restrict the time available for parallel courses dealing specifically with individual management disciplines. In contrast, a course too heavily weighted towards the latter may under-emphasize the ecology content. Fortunately, an elementary examination of various environments and eco-systems, from tropical forests to tundra, from hill sheep grazing to red deer management, or from the micro-climate of crops to the favoured habitats of insects and pests, reveals that several common features and processes are involved. The critical examination of these and their underlying causes, and the high-lighting of similarities or differences can provide a new

analytical approach to these situations which is both intellectually stimulating and practical.

Moreover, few problems relating to natural resources today can be solved or considered in isolation from other features of the environment. A cutting policy in forests, for instance, has implications for river flow, water yield, possibly for irrigation or the transport and breakdown of pollutants, as well as for the wildlife inhabitants of the forest. Again, the application of chemical sprays or fertilizers in one part of a biological chain may have repercussions elsewhere. It is here that ecology, the science of inter-relationships, becomes the basis for an approach to resource management situations. Ecological principles and concepts must increasingly influence decision making at various levels.

Future managers of natural resources require an appreciation of the processes controlling biological production, as well as a firm grounding in the fundamentals of management science and economics. A degree course based on these concepts must implicitly embrace several of the traditional disciplines. But it is the integrated approach to ecology and, hence, resource management which has been deliberately made the foundation of the Edinburgh degree course in Ecological Science. Lessons of ecology and management are taught in the context of whichever production system is most appropriate to a particular section of a course, whether this system be grazing, fisheries or forestry. All students are thus required to study and take part in disciplines they may never practice professionally, thereby, one hopes, coming to understand the overall need for co-operation in resource management and planning. The proper development of biological resources in the future surely depends on such an appreciation.

Ecology and the future

A potential hazard for the successful establishment of ecologically based courses stems from the fact that developments in the 1960s threw the term 'ecology' into new and unaccustomed prominence. Coined by Haeckel a century earlier to describe the inter-relationships between plants and environment, later applied by plant geographers to classifying the diversity of associations and distribution in natural vegetation types and, even later, borrowed by a few field zoologists to describe the study of animal populations and fluctuations, the word itself is not new. But the tide of publicity of the 1960s, swollen considerably after the appearance of such books as Rachel Carson's *Silent Spring*, seemed in danger of turning ecology into a movement, a vocation or, at least, a dedication to the conservation of environmental quality. Taken to extremes, an evangelical or doctrinaire connotation could have destroyed ecology as a serious scientific and intellectual discipline. Fortunately, the immediate danger of this happening has passed. On the positive side, however, the publicity given to conservation questions has attracted the attention of able school leavers to University courses in ecology, a demand which seems likely to increase. It is to be hoped that many of these will, in the future, take up worthwhile employment in occupations connected with the land. Not, of course, to the exclusion of other professions but as additions to multi-disciplinary teams. It is here that the individual can benefit from the healthy counterpoise of criticism and suggestion from others not similarly trained or educated but facing a common goal.

This article has been contributed by **J. M. Caborn, B.Sc., Ph.D.**, of the Department of Forestry and Natural Resources of the University of Edinburgh.

This article describes an experiment into the economic benefits of drainage for grass in a high rainfall area.

The Langabeare Drainage Experiment

B. D. Trafford

To anyone without a good knowledge of British agriculture it would seem that the major part of our field drainage would be carried out in the wetter west and north of the country. In fact, precisely the reverse is true. Statistics show that in recent years about 12 acres in every thousand are drained every year in the eastern counties, whilst the corresponding figure for the west is around 2½ acres. The reason behind this apparent paradox is simply the question of economics. Undoubtedly, the west needs the drainage but often the farming systems in that part of the country provide a lower return and the advantages of drainage are far less obvious than is the case with the expensive (and often high risk) cash crops so frequently grown in Eastern England.

It was against this background that a M.A.F.F. experiment was started in 1961 with the intention of providing better information on the benefits of drainage to grassland. The experiment was sited at Langabeare, near Okehampton, Devon, and this article describes in broad terms the work there and the results obtained.

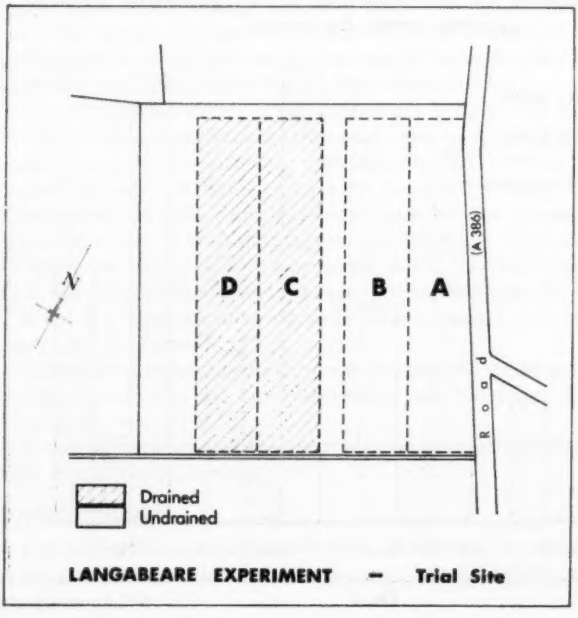

Fig. 1

Experimental details

The main method of measuring benefit was by comparing the liveweight gain of bullocks. To do this, the experimental field was fenced to give four plots each of about 4½ acres and a weighbridge was installed to weigh all the cattle regularly. The number of cattle grazing each plot was controlled by the normal concepts of good grazing management, e.g., the state of the surface, and the growth of grass. Fig. 1 shows the site and the general layout of the plots.

Treatments given to the plots were:

Plot A. No drainage and only initially fertilized.
Plot B. No drainage but regularly fertilized.
Plot C. Drainage and regularly fertilized.
Plot D. As C but also ploughed and re-seeded.

At the start of the experiment the whole area was covered with rushes; these were controlled by spraying in 1959. During 1959 and 1960, initial trials were held to ensure uniformity over the whole area and in the following year the plots were fenced and C and D drained. The fall was about 1 in 17 towards the south, and the drainage works consisted of laterals at 1½ chain spacing laid at an average depth of 42 inches across the fall. Each plot had a separate main, and a 'corridor' strip was left between B and C to minimize the edge effects of the drained plot upon the undrained. The soil in plots C and D was thoroughly shattered in 1961 and again in 1964 using a winch drawn subsoiler. On both occasions this work was well done under very dry conditions.

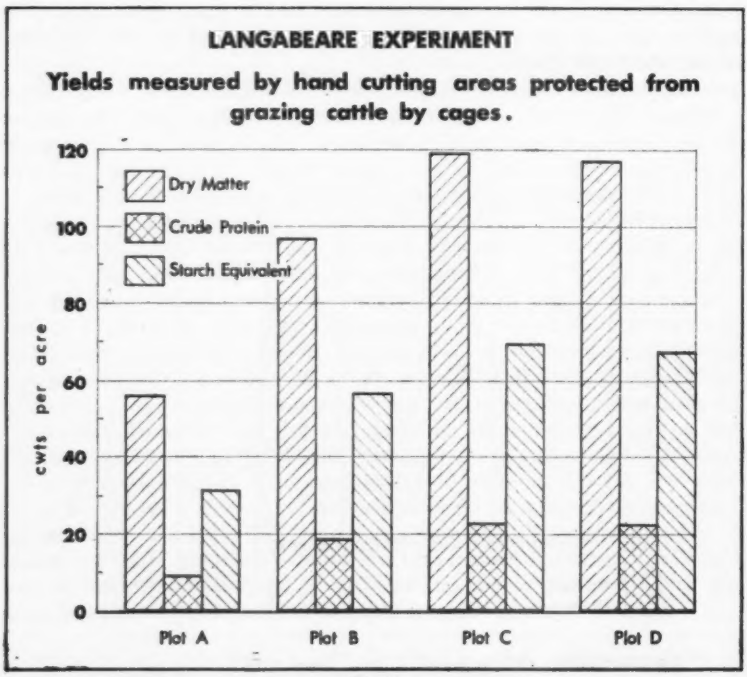

Fig. 2

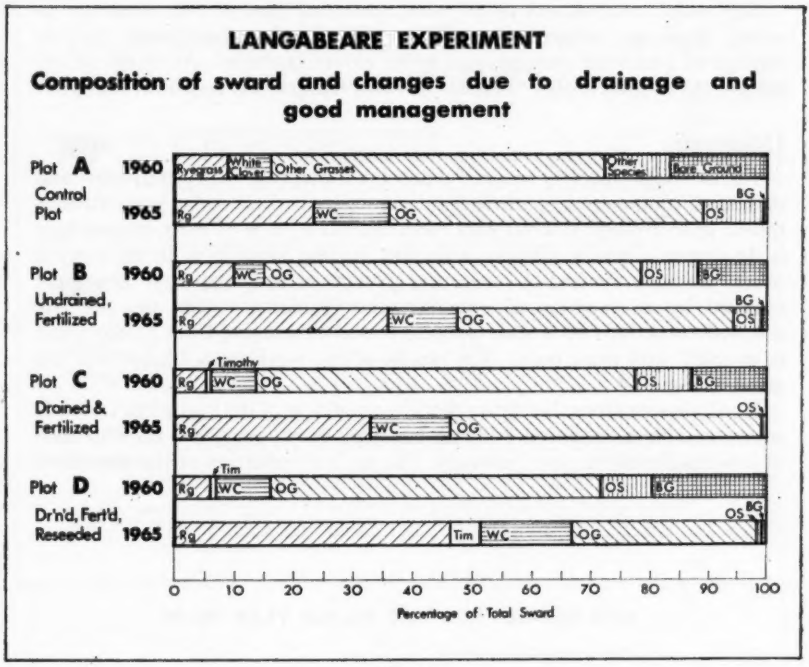

Fig. 3

The observations started in earnest in 1961 and the regular weighing of the cattle began in the grazing season of 1962. Full results were maintained until the 1964 season but due to a number of factors outside the control of the experimenters it was not possible to weigh the cattle during 1965; from that time only hydrologic information has been recorded.

The first requirements of an experiment such as this is to show that the treated plots are producing more grass and/or a better quality sward. The second is to improve surface conditions so that grazing is possible for the maximum period without damage by poaching. Finally, for drainage to be worthwhile, an increased liveweight gain of the grazing cattle must be achieved which is economic having regard to the increased costs incurred. In the initial design of this experiment fairly expensive drainage was chosen as it was felt that this would provide the best indicator for further work even if it did not itself prove worthwhile. The estimated cost of similar drainage work on a field scale is £75 per acre.

To obtain a measurement of grass production, grazing cages were used to protect small plots for hand harvesting and recording. The results of this work are given in Fig. 2.

It will be seen that all the treated plots gave considerable yield responses with plot C giving the best.

Sward quality

The botanical composition of the grazed sward was determined from time to time and the results at the beginning and end of the grazing experiment are given in Fig. 3.

The sward composition of all plots, including plot A, improved significantly. The area of bare ground fell to an insignificant value and the percentage of perennial ryegrass and white clover increased. As might be expected, the re-seeded plot—plot D—showed the greatest botanical change.

Drainage

The drainage was very successful and the differences between drained and undrained plots were very obvious during wetter periods of the year. Various results of hydrologic interest were recorded but what is of most interest here is the degree to which drainage improved grazing conditions. In the absence of any absolute method of measuring ground surface conditions these were assessed by an experienced operator who regularly walked the site. He assessed conditions on a scale between 1 and 12 ranging from frozen solid, to parched with grass burnt. The results of this work for a typical year are given in Figure 4.

It will be seen from this figure that the condition of drained plots C and D were worse than condition 8 (damp but firm) only during two short periods of frost in December and February. The surface condition of the undrained

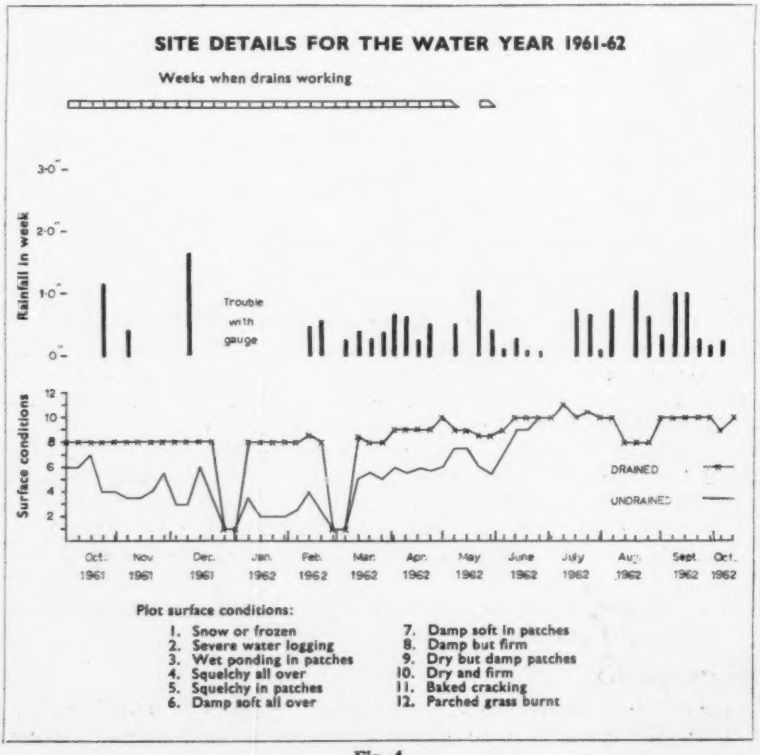

Fig. 4

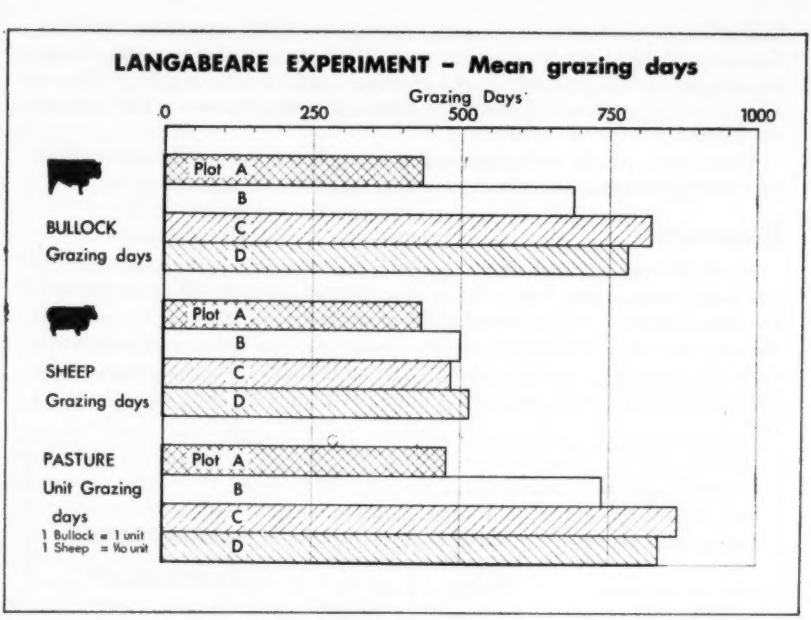

Fig. 5

plots varied much more in response to the rainfall but was often condition 4 (squelchy all over) or worse. It is an interesting fact that plot surface conditions became the same throughout only after drainflow ceased during the summer period. (It should be noted that separate records from plots A and B and from C and D are not plotted because the two in each pair behaved so similarly from the drainage viewpoint that they were treated as being replicates.)

Grazing

The controlled part of the experiment used grazing bullocks but in the winter the plots were also grazed by sheep. The number of sheep grazing days are recorded but no attempt has been made to take these into account in the liveweight gains or in any economic analysis. Thus any return for the sheep is treated as a bonus. Fig. 5 gives details of the grazing and shows that all the treatments gave substantial increases in grazing days with plot C giving the best result.

Results

The results show positive responses to fertilizer application both with and without drainage. They also show a good sward response to controlled grazing and management.

The re-seeding of plot D was disappointing in that the only noticeable beneficial effect was in sward composition; re-seeding, being an extra expense, depressed the economic return from that plot.

The drainage produced a marked response in results and readily observable

field differences. Its aim was success without too much regard for cost, and this was achieved. Indeed, the results would suggest that considerable economies might have been made in the drainage without serious risk of failure. To establish how much cheaper the drainage might become is likely to be the subject of a further experiment.

Many other results were recorded at Langabeare to provide information on water movement, soil structure changes and similar matters.

Economics

To the farmer the consideration which matters most is the economics of any improvement, and this is the most troublesome aspect for an experimenter. Data like weight of grass and cattle or cattle grazing days can be recorded without too much difficulty but where economics are concerned there are a mass of interacting variables which affect an individual's economic position. Taxation, interest rates, available capital, write-off periods—these are just a few.

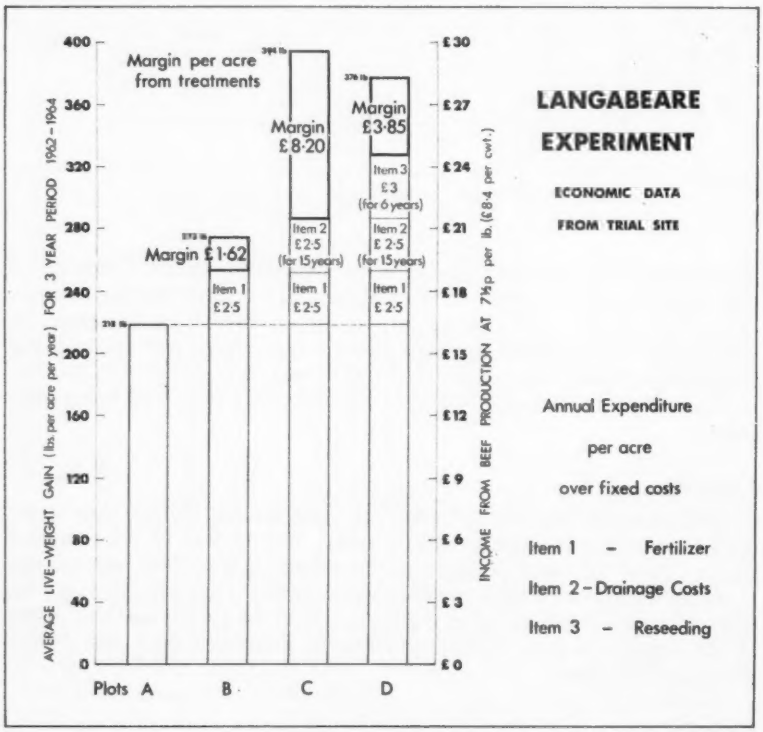

Fig. 6

Fig. 6 attempts to show in histogram form the results of one economic appraisal. The total height of the columns is proportional to the total return from the particular plot and the column itself is broken up into sections to show that part which must be appropriated to pay for fertilizer or fertilizer and drainage as the case may be. This isolates the section of the column which may be regarded as the 'margin' due to the particular treatment.

It is not claimed that Fig. 6 shows the only economic answer but it does show that in spite of the admittedly expensive drainage work plot C showed up well. Plot D, of course, was penalized because of the cost of re-seeding, which did not give commensurate benefit. The assumptions on which Fig. 6 is based are:

value of liveweight gain = 7½p per pound;
write-off period = 15 years;
cost of drainage = £75 per acre gross;
Ministry grant aid = 50 per cent.

No allowance is made for any extra livestock which might be needed and any return from the sheep is ignored.

Conclusions

The results suggest that even on poor soils, such as the Tedburn series on the Culm Measure clays of Devon, drainage is worthy of serious consideration, even for a low return farming system such as grazing bullocks. It seems likely that for intensive dairying the returns would have been considerably greater, which would have amply justified the drainage costs. On the other hand, the success of the drainage suggests that for low stress farming systems, such as grazing bullocks, a cheaper form of drainage might well have been adequate, with consequential economic benefits.

B. D. Trafford, C.Eng., M.I.C.E., A.M.I.W.E., A.M.I.Agr.E., the author of this article, is a Senior Engineer with the Ministry's Field Drainage Experimental Unit at Cambridge.

'DANGEROUS PLAYGROUND'

An Award-winning Ministry Film

A new colour film entitled *Dangerous Playground* has been produced by the Ministry of Agriculture, Fisheries and Food in an effort to bring home to all concerned the many ways in which accidents can happen to children on farms and to suggest means by which the present appalling loss of young lives can be reduced.

The film recently won the Silver Award in the 1971 competition of the British Industrial and Scientific Film Association. It vividly portrays a number of potential hazards on farms, from the terrifying sight of accidental fire to the violence of carelessly-handled guns. The message conveyed is clear and unforgettable.

The warnings contained in the film are very timely for, with the long summer days and the approach of the school holidays, children are likely to have more time on their hands and more opportunities to get into dangerous situations when playing on farms. It is suggested in the film that the best way to prevent accidents happening is for farmers to arrange for an area to be set aside in which children can play in safety, preferably under the supervision of an adult, instead of being allowed to wander at will through yards, buildings, and in fields in which machines of all kinds are likely to be working and where there are many other pitfalls for the unwary child.

Copies of *Dangerous Playground* are available, free of charge, for showing to any interested groups of people. Applications should be made to the Safety Officer at any of the Divisional Offices of the Ministry of Agriculture, Fisheries and Food. The film can also be borrowed from the Central Film Library, Government Buildings, Bromyard Avenue, Acton, London, W.3, for a daily charge of £1·60.

Land Reclamation on the North Yorkshire Moors

P. J. Chillingworth

DURING the last ten years several farmers have worked at reclaiming land on the less difficult fringes of the North Yorkshire Moors, in particular the south-eastern corner where the land is free-draining and relatively free from stone. A leader in this difficult enterprise has been Mr. R. J. Baker, who started farming at Givendale Head, Snainton in 1956 on 70 acres of marginal land, which included 20 acres of heather. Today, he farms 1,500 acres in the area on which he runs nearly 400 dairy cows and about the same number of followers. Two of the principal factors behind this achievement have been the application of the high stockmanship and grassland management standards that Mr. Baker learnt while working in New Zealand with a herd improvement association, coupled with a steady programme of reclaiming cheap moorland and marginal land. Several articles have been written about his stock and management methods and in this article I hope to add a little about his reclamation work.

Making a start

One of Mr. Baker's first tasks on arriving at Givendale Head was to plough out and re-seed the 20 acres of heatherland so that every acre of the farm could be used fully for dairy cows. Throughout, as each farm was purchased or rented, a programme of land reclamation and improvement, matched with a proportionate increase in stock numbers, has been started. This generally absorbed all available funds and was achieved at the expense of purchases of fixed equipment and buildings which, although needed, would bring no direct increase in revenue. Only the bare minimum of equipment such as milking bails was purchased and although working conditions were often spartan the objectives were achieved.

Heather to grass

The nearby Ebberston Common Farm was bought in 1964. This comprised 265 acres, 150 of which were heather moor, 40 acres very rough grass and the remainder very run down. An idea as to what might be done with the moor came when the electricity authority took a power line across it. Mr. Baker noticed that where soil had been spread around the pylons, the grass grew and flourished. He reasoned that given drainage, aeration and good management, the moor, which grew only heather or bracken, could be made

to grow grass for dairy cows. This proved to be the case and after ploughing all but 20 acres and breaking the pan beneath, the grass seed that was sown provided generous summer grazing. The reclamation technique was straightforward: the heather, gorse or bracken was burnt off during dry spells in the winter if possible or, if not, the land was thoroughly rotavated; the following summer it was ploughed to about 12 inches, so that a little of the clay subsoil was brought up; then dressed with ground limestone at 6 tons to the acre and basic slag at 10 cwt per acre. After rigorous seed bed cultivations a seeds mixture containing cocksfoot, ryegrass and timothy was sown together with 4 cwt per acre of compound fertilizer.

As always in farming, unexpected problems cropped up. The most serious was in 1969 when very severe damage was done to the maiden ley during the winter by leather jackets. This left large areas bare of grass in the spring and the whole area had to be re-seeded. The crane fly appears to increase in numbers over several years until it reaches plague proportions, doing severe damage before dying back again, although the cycle is not regular. In future, Mr. Baker will take note of the concentration of flies during the autumn, so that bait can be laid if necessary.

Trace element deficiencies have also been a problem. Copper has had to be injected into the soil regularly and a very close watch kept at critical times of the year for 'staggers'—magnesium deficiency—even if a magnesium supplement is being fed.

The fertility build-up in this naturally barren land is a long term job because at the outset there is practically no useful bacterial life due to the high acidity, the initial pH being between 3·6 and 3·8. As the conditions become more tolerable even earth worms start appearing in small numbers. In the early years the nutritional value of the herbage is low and only rises as the soil conditions become more normal; an important factor if dairy cows are utilizing the grass, because supplementary feeding will have to make up any deficiencies.

Part of the cost of the early reclamation was met from the £12 per acre ploughing grant. Since 1967 re-seeding and fertilizer works have qualified for grant under the Hill Land Improvement Scheme and a similar grant will be payable under the new Farm Capital Grant Scheme which replaced the existing schemes on 1st January 1971.

Reclaiming Grime Moor

More land adjacent to Givendale Head was taken and then in 1967 the tenancy of Low Pastures Farm at Lockton was obtained from the National Trust. This comprised 838 acres, of which some 580 was moorland with the evocative title of Grime Moor. Another dairy herd was quickly established on the better land and this has helped to improve the grassland by rotational grazing, coupled with a fairly high rate of fertilizer application.

The following year a start was made on reclaiming Grime Moor. The area chosen was the furthest from the buildings and some of the driest. Approximately 180 acres of the easier land were ploughed out with 60 acres being sown to S59 Red Fescue for seed production. Mr. Baker felt that this pioneer crop would give a quick return while the areas better suited to livestock were being brought into use. In fact, the first year's crop fully justified the experiment, but the crop was less successful in 1970 possibly due to the exceptionally dry conditions. Ploughing has proceeded and a further 120 acres were seeded

in 1970 and now show a useful sward, mainly because of the excellent weather during the summer and autumn. There are now only approximately 60 acres of land that can usefully be ploughed, the rest will remain in its natural state because it is either too steep, wet or rocky.

The problems on Grime Moor are rather different from those of Ebberston Common. On Grime Moor the peat varies in depth from 4 inches to 3 feet and overlies leeched sand and an iron pan. The surface is uneven so that after burning off the heather work with a bulldozer was required to level the many natural drainage gullies. Stones have been a problem at times, but have not seriously held up work. The plough used has been fitted with a subsoiling attachment for breaking the pan and generally cracking the subsoil to facilitate drainage and aeration.

Fencing and water supply

Two essential requirements before stock can utilize the new grass are, of course, fencing and water supply. As only cattle will be using the land a three-line barbed wire fence is being used. Erection is undertaken economically by farm labour, reducing the final cost to about 17½p per yard before grant.

Water for the cattle looked like providing Mr. Baker with a serious headache. At the highest point the land is over 900 feet above sea level and some 1½ miles from the nearest main; the lift of 300 feet over such a distance would have made the cost of pumping equipment prohibitive. The solution was found in open reservoirs to store surface water. This idea had been tried successfully by Messrs. G. B. Grant and Sons (Farmers) Ltd. at neighbouring Newgate Foot, who are doing similar reclamation work. Suitable sites were chosen in natural valleys and a bull dozer was used to form earth dams. Three have been constructed during 1970 and are working successfully. At first the water tends to drain through, but as the silt carried in the water gradually seals the earth bank, it becomes watertight. Mr. Baker estimates that the largest reservoir holds around 250,000 gallons. Of course adequate provision must be made for overflow at times of heavy rain and melting snow and in the largest dam an 18-inch pipe is installed.

The fencing and reservoirs (along with the recent reclamation and seeding) have received grant aid under the Hill Land Improvement Scheme, thus permitting work to proceed at a far faster pace than would have been possible without such help. Even so, works on such a scale are a severe drain on available revenue for they must keep pace with the increase in stocking which also requires heavy expenditure of capital.

Costs

The gross cost per acre for reclaiming operations on Grime Moor for liming, fertilizing, levelling, burning, cultivations and seed, have amounted to around £37 per acre. After deducting fertilizer and lime subsidies and the Hill Land Improvement Grant, the net cost has amounted to about £15 per acre. To this must be added over £1,000 for fencing and £2,000 for water storage, both before grant, and the capital value of some sixty head of stock. It can be seen that this kind of operation needs very careful financial planning.

Amenity effects

Looking at the work from the point of view of the general public, it must be asked whether reclamation detracts from the amenity of the area. Grime

Moor is visible from the Bride Stones rock features, which are scheduled as of geological interest and attract large numbers of summer visitors, and so the work may cause some unfavourable comment from those who like to see the moorland landscape unchanged. However, beauty being in the eye of the beholder, it can be argued that the new expanse of rolling grassland with its grazing cattle will be just as pleasing to most. Not only has an unproductive tract of land been made to yield a return to the farmer and food for the nation, but the change will attract a new range of fauna to the area, an example being the wild duck which have already found haven on the new stretches of water.

The author, **P. J. Chillingworth, N.D.A., A.R.I.C.S.,** is an Assistant Surveyor with A.D.A.S., stationed at Northallerton.

Ministry Publications

Since the list published in the June 1971 issue of *Agriculture* (p. 272) the following publications have been issued.

MAJOR PUBLICATIONS

BULLETIN

No. 181. Control of Rats and Mice (Revised) 50p (by post 52½p)
(SBN 11 240481 2)

OUT OF SERIES

Aspects of Dairy Economics 1966–69 (New) 50p (by post 54½p)
(SBN 11 240528 2)

FREE ISSUE

ADVISORY LEAFLETS

No. 89. Couch or Twitch (Revised)
No. 91. Beet Leaf Miner (Revised)
No. 452. Wild Oats (Revised)
No. 573. Transmissible Gastro-Enteritis of Pigs (New)

SHORT TERM LEAFLETS

No. 57. Buildings for the Single Suckled Herd (Revised)
No. 92. Black Grass (Revised)
No. 122. Chrysanthemum Pests Under Glass and their Control (New)
No. 125. Frost Protection of Fruit Crops by Water Sprinkling (New)

DRAINAGE

No. 3. Drainage Advice (New)

FARM WATER SUPPLY LEAFLETS

No. 1. Protecting Your Water Supply

UN-NUMBERED LEAFLET

Sharka (Plum Pox) (New)

Priced publications are obtainable from Government Bookshops (Addresses on p. 326) or through any bookseller. Single copies of the free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT.

Farming in the Yorkshire Wolds near Warter

48. East Riding of Yorkshire

A. M. Sutherland

ALTHOUGH the East Riding may not possess the magnificent scenery of the West and North Ridings of Yorkshire, it is an extremely satisfying area for the visitor with an interest in agriculture. In contrast to the other counties lying north of the Mersey and Humber estuaries, it has little hill and moorland grazing and its attraction lies solely in the pattern of its well ordered farming.

The Yorkshire Wolds, an undulating plateau of chalkland divided by a series of dry valleys, cover nearly half the East Riding's 640,000 acres of farmland. On the East coast, the chalk rises vertically from the North Sea in the spectacular promontory of Flamborough Head and swings in an arc as far west as Malton before turning south through Market Weighton almost to the Humber, a few miles upstream from the busy port of Kingston upon Hull. To the north, the Wolds present a steep scarp edge overlooking the Vale of Pickering, the site of a great lake which was once part of the North Sea, but whose outlet was blocked by the ice so that the area is now drained by the River Derwent. The Derwent, although rising within 4 miles of that same North Sea, has a tortuous course of 60 miles before joining the tidal water of the Humber between Selby and Goole. In the west, too, the ascent is steep, rising from the Vale of York to the highest point near Garrowby Hill at a little over 800 feet in altitude.

Enclosures

Enclosure came late to the Wolds, the landscape as we now know it today being largely determined at the end of the eighteenth and early in the nineteenth century. In contrast to the earlier enclosures in the county, which concerned groups of farms situated in villages, the Wolds generally had the individual farm as its focal point, hence the developed pattern of isolated holdings with the farmsteads protected by substantial shelter belts, which is so characteristic of the area.

Foremost amongst the improvers of the period were the Sykes family, of Sledmere, an estate noted not only for its agricultural development but also for its famous Stud. Sledmere is only one of several large estates spanning the Wolds where the landlord and tenant system still reigns, although there is an increasing tendency for the landowners themselves to farm such holdings as they become vacant. One of the largest transactions in agricultural land ever to be completed in this country took place a year or two ago when the Guinness Family Trust acquired Warter Priory at a figure reputed to be £4¼ million; two-thirds of the estate is farmed by the new owners.

Wold farming

Examples of the classic four-course rotation, for so long the basis of Wold farming, with its sheep on roots and clover, alternating with corn crops, are still to be found. Although the four-course rotation was widely extended to include an extra corn crop, it is only within the last decade that more intensive cereal growing has largely supplanted the four- and five-course systems. With the extensive fields, and a soil structure which can readily carry long runs of cereals, mechanization has been able to fulfil its role of labour substitution, so that one finds units with 200–250 acres per man and 75 to 80 per cent or more of the land in corn.

Sheep remain an important enterprise although the numbers have declined by one-third since 1963, but there is increasing interest in beef production—often either the 18 month old semi-intensive system (as practised at High Mowthorpe, the Ministry's 1,000 acre Experimental Husbandry Farm near Malton, whose work has been an important influence in the changing practices of Wold farming) or suckler herds running in the Dales.

Vale of York

The south western part of the East Riding lies in the Vale of York, an area notable for the variety of its soils. The bed of the Vale is of lacustrine clay, in most parts covered by water and wind-borne post-glacial sands. Farms here tend to be smaller than those on the Wolds, but their systems are more intensive with potatoes and sugar beet the key crops in their economy. A tendency to drop the one-year ley from the system has probably contributed to the problems of low organic matter which are seen on some of these soils. 'Blowing' creates difficulties in spring time on the lightest of the sands, and a limited amount of the old practice of marling is still carried out each year, mechanical methods having restored the economic possibilities of the practice which had been held in abeyance during the years of depression.

Plain of Holderness

The East Riding's third major farming area lies in the Plain of Holderness, roughly south and east of a line joining Bridlington, Driffield, Beverley and Kingston upon Hull. The boulder clay soil varies in texture from medium to heavy, with the greater proportion at the heavier end of the range. Holderness has long been noted for its wheat and very high yields are obtained on its fertile soils in most seasons. On some of the lighter boulder clays, and on the warp soils—the latter being found near the bank of the Humber—potatoes are an important crop, but sugar beet growing is precluded by the long distances from factories. The port of Hull has a number of industries whose by-products are a valuable source of animal feedingstuffs—fishing, oil seed crushing and flour milling. So most Holderness farms have for long carried on an intensive pig or poultry unit to utilize this readily available supply of animal feed.

Pigs

In the last few years the need to raise the returns from barley growing has prompted a dramatic explosion in the pig population. The East Riding contributes 6 per cent of the national pig herd, and its numbers are exceeded only in Norfolk and Suffolk. The rate of expansion has been rapid and whilst the national herd has only shown a marginal increase, the East Riding herd has increased by a third since 1965, by far the greatest development having taken place in Holderness. Naturally, such intensive production throws up its problems, of which not the least is that of effluent disposal.

Horticulture

The Cottingham and Welton areas are notable for their intensive horticulture, the system of production under lights brought here in the 1930s by Dutch settlers having undergone extensive development in the last few years into heated glass-houses. Production is concentrated on salad crops, cucumbers becoming of increasing importance, over a fifth of the national crop now coming from the area.

DAIRY SHOW CHANGES SHAPE

An International Dairy Event is planned for the end of April 1972 by the Royal Association of British Dairy Farmers. It will take place within a compact area of the Royal Showground at Stoneleigh, and although it will appear in an entirely different form from the Dairy Shows held in London for over 80 years, or indeed any other agricultural show, it will include limited economic milk production trials as well as performance and inspection dairy cattle classes.

The announcement was made by the Deputy President, the Lord Swaythling, O.B.E., at the Annual General Meeting of the Association.

Performance and inspection classes will also be provided for each dairy breed, based on one class for each breed. These classes will lead up to an interbreed competition for the Supreme Individual Championship and other trophies. Dairy beef will continue to be featured, including the Trehane Trophy Competition. One class will be provided for Bull Beef.

1,750 gallon milk tanker at the farm

Farm Access and the Large Road Vehicle

L. Wrathall, *A.D.A.S., Wolverhampton*

OFTEN, when passing through country districts, the driver of a large goods vehicle is envied his elevated position by the drivers of family saloons and sports cars because of the long views he can enjoy. On the other hand, how often are his difficulties fully understood when his vehicle with its large overall dimensions has to be taken on to the farm? Probably not very often. The time has come for us to look much more closely at what provision is made on farms for the reception of such vehicles. A conference held recently at the headquarters of the National Farmers' Union highlighted the difficulties some operators of heavy transport experience in transporting goods in country districts and on farms; difficulties which arise because compelling economic considerations have led to a rapid increase in size of the vehicles which has outstripped improvement in access arrangements.

New order of size and weight

Before adequate provision can be planned on farms for the new breeds of heavy goods vehicle (H.G.V.), it is necessary to know what the overall sizes, including heights and turning circles, are likely to be in the foreseeable future. Recent trends suggest that overall sizes of about 8¼ ft width, 49¼ ft length and possibly 15 ft height will be normal. Grain and milk tankers are frequent visitors to many farms, and these can be up to 33 ft long, about 8¼ ft wide, and have a turning circle of 68 ft. These vehicles must be able to operate on farms in all weather conditions and must have unimpeded access from the farm gate to the collection or discharge point. Articulated vans, trucks and tankers which may call at farms can be as long as 50 ft overall. Typical turning circles are 43 ft for a 23 ft long tandem truck and 59 ft for an articulated vehicle 50 ft long overall.

Bulk milk tankers currently in use throughout the country vary in capacity from about 1,750 to 2,700 gallons. The larger vehicles are usually articulated but in many areas are gradually being phased out in favour of rigid vehicles. Overall length of the smaller tanker is 24 ft, width 8 ft and height 10 ft, with a turning circle of about 52 ft; the gross vehicle weight is some 16 tons. At the other end of the scale, the 2,700 gallon tanker is 32½ ft long 8 ft wide and 10½ ft high; being articulated its turning circle is only about 35 ft. The vehicle having the largest turning circle in this range is the 27¾ ft rigid tanker which needs 58 ft.

The largest road vehicles for carrying grain in bulk are about 12 ft high and 8¼ ft wide (plus the projection of driving mirrors). In the case of tankers or trucks equipped for tipping, the height when tipped can be as much as 35 ft for the very largest. These are not the biggest vehicles in common use but are the largest likely to visit farms; others of the 'long haul' type can have turning circles of 100 ft.

In order, therefore, to allow these vehicles to manoeuvre on farms, allowances must be made for their widths, turning circles and heights. Also, of course, the weight-bearing capacity of the various paved surfaces to be used by them must be looked at rather carefully to make sure they are adequate. Maximum wheel loadings of bulk milk tankers, for instance, vary between 3 and 5 tons according to the size of the vehicle. Overall gross weights, too, will vary but vehicle weights of up to 32 tons should be allowed for on all main farm roads.

Roads and gateways

Not only must the main access road up to the farm buildings be adequate in all respects, but the main farm entrance off the public highway should also allow all vehicles to turn in easily without reversing. Several organizations have recently produced recommendations for the design of farm entrances. All agree that the main points to consider are, first, the width of the carriageway of the public road; second, the width of the farm road itself; and, lastly, the turning circle of the vehicle. The driver should be able to turn in without difficulty and without reversing, using the full carriageway width if necessary. If there is a gate it should be set back about 50 ft from the carriageway to allow for the vehicle to stand off the public road whilst the driver opens or closes it. Cattle grids of sufficient strength and construction are an obvious advantage at such places because they help to avoid delays. Also,

of course, good visibility in all directions is essential at the point where the two roads meet. The Highway Authority must always be consulted when a new access is to be constructed or where an existing one is to be altered so that, among other things, sight lines can be agreed.

Main farm roads should be at least 10 ft wide but preferably 14 ft to allow for good wheel weight distribution. Weights of up to 5 tons per sq. ft should be anticipated over the full road width, remembering that cattle grids and manhole covers will also need to be equally strong. Roads should be widened by 2 ft or more on curves to allow for the 'inner swept path' of the vehicle.

Because of the high cost of well constructed roads and the relatively low volume of traffic using them on farms, single carriageways only are normally provided. Where the road is a quarter of a mile or more in length without variation in width, 'passing places' or 'lay-bys' should be provided. These should be 40–60 ft long, as wide as the road itself and sited on straight and level lengths where there is good visibility both ways. They can either take the form of a widening on both sides or, alternatively, they can be distinct passing places on one side of the road only.

It is best if fences at the sides of roads are set back at least 3 ft from the edge to allow for large overhanging loads. The clear height above all roads and entrances used by the largest road vehicles should be 16½ ft, which is the design standard laid down by the Ministry of the Environment (Transport).

The tanker driver likes to enjoy his work. Do not spoil his trip for a ha' pennyworth of tarmacadam—or concrete!

RESULTS OF POLE BARN COMPETITION

Farmer-designed pole barns were awarded the first three prizes in the Farm Building Centre Economical Pole Barn Competition, which was sponsored by the Crown Estate Commissioners and mentioned in *Agriculture*, November 1970.

Many of the 24 entries, from farmers, surveyors, architects and manufacturers, were considered by the judges to be stimulating designs, but some, in spite of their ingenuity, were not considered to be sufficiently practical to qualify as economical farm buildings solutions.

The first prize of £50 was awarded to W. H. Evans of Stockland, Somerset, for a pole-type sheep house, constructed predominantly of cheap materials. D. J. Castle, of Charlton, Berkshire, was the second prize winner, his entry being for a beef house constructed of round poles. The third prize of £10 was awarded to J. M. Whitaker, of Troutbeck, Cumberland, for a very simple and small sheep house, which the judges felt was probably a very attractive building appropriate to its situation on a hill in an area of outstanding natural beauty. Two special prizes of £5 were awarded: one to I. H. Paxton of Follifoot, Yorkshire, for a general purpose, timber-framed structure and the second to J. R. McCutchan of Arlington, Sussex for a very large turkey shed. The £10 award for the best building constructed of home grown timber was given to A. C. Perryman of Crediton, Devon, who entered a general purpose structure.

The judges were R. S. Hollins, Chartered Surveyor and farmer; V. Johnson, Chartered Structural Engineeer, T.R.A.D.A., and T. A. Oxley, Director, Forest Products Research Laboratory.

Plans, drawings and further details of the winning entries will be on display in the Exhibition Buildings of the Farm Buildings Centre during the Royal Show.

in brief

- **Maize in southern England**
- **Calf comfort**
- **Weald and Downland Open Air Museum**

Maize in southern England

THE commercial possibilities of growing maize in England have been brought distinctly nearer in the past few years by the availability of early maturing hybrids produced by crossing inbred lines of flint and dent types of maize. The latitude barrier of adverse spring temperatures has been pushed steadily northwards as worthwhile crops are reported from northern France and the Netherlands. About a quarter of a million acres are being grown up to 50 miles north of Paris, and about one-third of the arable acreage of Brittany is under the crop; in Holland 2–3,000 acres of maize are being grown for grain. The south and east of England can now be considered to be within the northern limits of cultivation, and yields of 38 cwt of grain per acre (15 per cent m.c.) have been cited as realistic: well-grown crops have yielded as much as 42–45 cwt per acre in favourable years.

The extension of interest into this field of cereal research and development by the Home Grown Cereals Authority is therefore especially welcome. At the Authority's suggestion, the maize development work proceeding at Wye College has been reorganized into the Wye College Maize Unit and, at the same time, it has increased its financial support to allow the Unit to maintain outstations in Essex, Suffolk and Hampshire. The work of the Unit, under the direction of Dr. G. M. Milbourn, covers agronomic experiments, engineering work related to harvesting and drying, economic studies (including farm costings on a considerable scale) and the integration of this new crop into farm production programmes.

Over 3 million tons of maize are imported into Britain every year. Considered in the light of the present high price of feed grains, this is perhaps a good argument in favour of establishing maize growing wherever our climate is favourable to it. In a very helpful handbook* written by Dr. Milbourn and published by the H.G.C.A., a map prepared by the Meteorological Office from weather records and known maize ripening characteristics shows the areas in southern England where grain maize has the best prospects. 'Every 1 per cent of the existing acreage of conventional cereals in these areas converted to maize is', says the H.G.C.A., 'a potential 35,000 tons of maize which at current yields is worth £1 million in foreign exchange at current prices'.

The place of maize in the rotation may normally be seen as a one-year break in arable farming or in a mainly cereals programme, or it could be taken for two consecutive years to allow a more thorough control of grass weeds. 'Even continuous growing for five years or more', says Dr. Milbourn, 'could be carried out without fear at present of pest or disease build-up, and it seems probable that any yield decline resulting from a long run of maize crops would be less than is experienced with wheat and barley'. It is a tailor-made crop for mechanization, is resistant to eyespot and the foliar diseases of wheat and barley, and both its sowing and harvesting times fall conveniently outside the peaks imposed by conventional cereals. Based on the knowledge and experience which it is the intention of the H.G.C.A.

*_Maize for grain_. Obtainable, price 40p, from the Home Grown Cereals Authority, Haymarket House, Oxendon Street, London S.W.1.

to foster, and on the progressive studies which will be the role of the new Wye unit, it may be that English maize could become the cereal marketing development of the century.

Calf comfort

Of all classes of farm stock, perhaps the most vulnerable to an adverse environment is the calf. In those first few weeks, before being turned out to clean pastures, it is within the power of stockmanship to influence the course of the animal's whole life. At this time the quality and conditions of housing are of such importance that to neglect them, if only to a minor degree, is to court the kind of loss to which, unfortunately, too many farmers can testify. Calves are particularly prone to respiratory diseases, from a mild bronchitis to pneumonia. At one extreme mortality is heavy; at the other, disguised losses in the form of retarded growth and general health may inflict an even greater economic loss in terms of future milk and meat production. With every increment in intensification, it follows that the individual circumstances of calf housing must be watched with added vigilance.

Much the greater part of calf comfort resides in the housing environment, which means, briefly, air temperature and relative humidity. Below a temperature of 10–13°C a young calf will start drawing on its growth potential to maintain its body temperature, and indeed for the first month a stabilized temperature of 13–16°C is recommended. Thereafter, the temperature may be reduced gradually to a minimum level of 7°C at twelve weeks of age. The relative humidity is of equal concern, since at low temperatures (say 5°C) the loss of body heat is increased, and at the other end of the scale (say, above 18°C) high relative humidity restricts the loss of body heat which is normally regulated by sweating and respiration. High relative humidity also causes condensation on cold surfaces within the house, which in turn makes bedding damp and generally worsens the environment. Any rise above 75–80 per cent should be avoided by efficient ventilation to provide fresh, dry air without draughts. A comfortable calf is a thriving calf and as such is an investment to be protected.

Weald and Downland Open Air Museum

A new link with rural and agricultural history has been forged in Sussex by the establishment of the Weald and Downland Open Air Museum on a 35 acre site at West Dean. Fundamentally this is a salvage operation over a 'catchment area' comprising the whole of Sussex, Kent and parts of Surrey and Hampshire. All too readily fine, period farmhouses, barns, granaries and other buildings that have seen long service in a now vanished rural Britain are reduced to rubble as the demolition men move in to make way for sand and gravel extraction, new or wider roads, additional water supply or, in town centres, a shopping precinct or supermarket. Where the Museum authorities are unable to preserve such a building *in situ*, it is carefully dismantled and re-erected at West Dean to make a harmonious complex that will perpetuate a wide and representative variety of traditional small buildings characteristic of the Weald and Downland.

In this the Museum's first year there are, amongst other exhibits, already two fifteenth century timber-framed farmhouses saved from reservoir workings in Kent and a Wealden hall as the focal point of a group of farm buildings. An early nineteenth century weatherboarded toll cottage, which formerly exacted charges on the Steyning–Shoreham turnpike, now has a not dissimilar function at the entrance to the Museum grounds! These, together with a huge, water-powered tilt-hammer that once rang through the Wealden forest, a charcoal burner's hut and kiln set in the ground's woodland area, and an old donkey wheel, offer immeasurable interest to the student of rural history, architecture and the casual visitor alike. Here is something of the past in three dimensions which brings textbooks to life and makes plain what may otherwise be only dimly imagined.

Journal of the Royal Agricultural Society of England. 1970 issue. John Murray.

Farmers and growers will find much to interest them in the special articles and reviews of research progress which form the major part of the Journal.

An interesting contribution deals with the early history of plant breeding and with developments in Great Britain, notably the improvement in varieties resulting from the stimulus given by the establishment of plant breeders rights. Some indication of this is, perhaps, given by the fact that in the past ten years the order of importance of barley varieties in the N.I.A.B. List of Recommended Varieties has changed five times.

Another special article discusses the profitability of sugar beet growing and puts forward a reasoned case for an increase of acreage, more especially if we were to join the Common Market.

From an article on metrication and the farmer one learns that adoption of metric units is at present voluntary, but several industries are already advanced in it and it is envisaged that the 1973 Price Review will be totally in metric units.

Other authoritative authors deal with milk production, agricultural co-operation and agriculture in Lincolnshire.

The Farmer's Guide to Agricultural Research is always very readable. These reviews are headed with a special research article on the health of seed potatoes with reference to the improvement due to propagation of nuclear stocks, freed from tuber-borne fungi which attack the crop, by the use of stem cuttings.

The reviews include a summary of progress in the breeding of farm livestock with interesting sidelights on the heifer progeny test. Other reviews cover developments in soils and fertilizers, in the feeding of farm livestock, in field drainage and in systems of machine milking.

Copies of the Journal can be obtained from the Royal Agricultural Society of England, 35 Belgrave Square, London, S.W.1. Price £1 (postage 15p extra).

A.J.L.L.

Build Your Own Farm Buildings. Fourth Edition (Revised). FRANK HENDERSON. Farming Press, 1971. £1·80.

There can be few better examples of the practical farmer than Mr. Henderson and, like other farmers, he has had a good deal of experience of work in the farmstead as well as in the fields. He also had the foresight to serve an engineering apprenticeship before entering agriculture and has more recently won several competitions for farm building design and worked as a farm building consultant. It is, therefore, not surprising that his do-it-yourself textbook, first published in 1955, has now, with appropriate revisions, reached its fourth edition.

He begins with the 'vital decision' on what to build and where to build it and gives advice on the preparation of plans and application for grant. He continues with a chapter on materials and then works his way from drains and foundations by way of walls and floors to the roof, including on the way plastering and plumbing; insulation and ventilation, glazing, painting and tiling. Other sections deal with roads and fences, electrical installations and repairs and maintenance. Seventeen appendices give basic information in tabular form. He writes in the direct and factual style of 'someone who has been there', combining sound general advice with detailed hints, and illustrating his text with nearly a hundred well-chosen photographs or drawings.

As its title implies, the book is concerned only with construction, not with design, and within its terms of reference it provides an admirable and cheap manual for the handyman farmer anxious to reduce capital costs. It assumes, however, a fairly high standard of craftsmanship and would be improved by the inclusion of a list of relevant advisory publications and sources of technical information. For, surely, the kind of man who uses this book is also one who will seek further knowledge and guidance elsewhere.

N.H.

T.V. Vet. Book for Pig Farmers. Farming Press, 1971. £1·80.

The second edition of this well-known book runs to some 150 pages and is illustrated by over 280 photographs. The author's preface rightly places emphasis on preventive medicine by recommending the practice of good husbandry methods and co-operation with the Veterinary Surgeon; the theme, which continues throughout the book, is to keep pigs healthy rather than treat disease. It is pointed out that housing, feeding and general management make highly significant contributions to the health of the herd but are largely beyond the scope of this work and so the reader is referred to more specialized publications on these matters.

The contents of the book are well arranged and diseases are grouped as far as possible according to the age and type of pig most likely to be involved. General diseases are considered under such logical headings as skin diseases, parasites etc. One section is devoted to lameness which is particularly pleasing as the problem is rarely given the attention it deserves. Each condition is discussed under the headings of cause, description of affected pigs, treatment and prevention. The table of contents and the somewhat brief index should enable a subject to be located fairly easily.

As with the previous edition, great use is made of photographs in an attempt to describe every condition, supplemented by a text that is therefore brief but factual and written in plain language. The method usually succeeds but in some instances it plainly fails because the illustration either cannot portray the condition being described or is superfluous, for example anoestrus and infertility.

This book can be recommended to all pig farmers as a useful guide to the common ailments of the species and may be considered required reading for stockmen. The approach is down-to-earth and the solution to each problem is discussed from the practical and economic points of view always emphasizing that 'prevention is better than cure'.

J.M.W.

books received

Gwydyr Forest in Snowdonia. Donald L. Shaw. Forestry Commission Booklet No. 28. H.M.S.O., 1971. 40p.

Metric Conversion Tables and Factors for Forestry. Forestry Commission Booklet No. 30. H.M.S.O., 1971. 50p.

Conifer Woolly Aphids (Adelgidae) in Britain. C. I. Carter. Forestry Commission Bulletin No. 42. H.M.S.O., 1971. 75p.

Development of Glasshouse Techniques for Early Progeny Test Procedures in Forest Tree Breeding. Forestry Record No. 74. P. R. Herbert. Forestry Commission. H.M.S.O., 1971. 20p.

Design, Construction and Maintenance of Earth Dams and Excavated Ponds. Forestry Record No. 75. E. F. Granfield. Forestry Commission. H.M.S.O., 1971. 17½p.

Commercial Rabbit Production. Bulletin No. 50. M.A.F.F. H.M.S.O., 1971. 45p.

Control of Rats and Mice. Bulletin 181 (Second Edition). M.A.F.F. H.M.S.O., 1970. 50p. (52½p by post).

Annual Report of Studies in Animal Nutrition and Allied Sciences. Vol. 26. 1970. Rowett Research Institute, Aberdeen, Scotland. 70p (including postage).

Background to the E.E.C Cereal Market. 1971. Copies from the Home-Grown Cereals Authority, Haymarket House, Oxendon Street, London, S.W.1. 50p (including postage).

Moving off the Yield Plateau. Edited by J. D. Easton and R. D. Munson. American Society of Agronomy, 677 South Segoe Road, Madison, Wisconsin 53711, U.S.A., $3.

Rothamsted Experimental Station Report for 1970. Parts 1 and 2. Copies from the Librarian, R.E.S., Harpenden, Herts. Price (post free) for both parts £2 (not sold separately).

Agricultural Chemicals Approval Scheme

Fourth List of Additions and Amendments to the 1971 List of Approved Products for Farmers and Growers.

NEW CHEMICALS

MECARBAM

An organophosphorus insecticide for control of apple and pear aphids and pear sucker. Applications for control of apple aphids give some control of apple sucker.

Liquid Formulations

Murfotox Liquid—Murphy

NEW USES OF APPROVED PRODUCTS

DEMEPHION

Now approved for control of aphids on carrot and pear. Appropriate applications for control of pear aphids control leaf hoppers and give some control of red spider mites.

PHORATE

The product 'Thimet Phorate 10% granules' is now approved for control of first generation carrot fly on celery.

NEW PRODUCTS CONTAINING APPROVED CHEMICALS

DICHLORPROP with MCPA

Ester Formulations

Cleanacres Octyl-Plus—Cleanacres

MANEB alone

Wettable Powders

Manate 80—Roussel

METHAM-SODIUM

Liquid Formulations

Maposol—Roussel

Company Information

The following firm has recently joined the Agricultural Chemicals Approval Scheme:

Roussel Laboratories Ltd.,
Roussel House
Wembley Park
Middlesex HA9 ONF
Tel: 01-903 1454

Correction (p. 156): The telephone number of Doff Portland Ltd. is Hucknall 2482.

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